# SPEED ZONE STUDY

# FOR STREETS AND HIGHWAYS



By

Highway Traffic Safety Division

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# SPEED ZONING ON MONTANA STREETS AND HIGHWAYS

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Montana Department of Justice

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# SPEED ZONING ON MONTANA STREETS AND HIGHWAYS

Speed Regulation is a subject of interest to almost everyone because, whether we drive or not, most of us are directly affected by the motor vehicle, that modern creation which is a blessing in some ways and a curse in other ways. There has always been a small segment of the motoring public which drives in a careless and reckless manner -- traveling much faster than conditions warrant. This leads to demands from all sides that definite rules be laid down regarding the operation of the motor vehicle and that special effort be made to control those motorists who do not use common sense to govern their vehicular speeds.

Early legislation regulating speeds was designed mostly from the viewpoint of the non-motorists and most of us are familiar with the old-time speed traps which were such a source of aggravation to the motorists and a source of revenue to some communities. As the number of motorists increased, however, their demands for more reasonable speed regulation were given consideration. Eventually, it was recognized that many of the existing speed limits which applied without regard to the type of road or its condition were not practical. This fact became more and more evident as the riding and handling characteristics of the automobile were improved and as portions of the rural road and highway network were also improved to the point where faster speeds were obviously both safe and practical.

Realistic speed zoning in Montana began in the early 1950's. It was at that time that the state legislature established the framework for the present speed zone policy which has been instrumental in the success of the speed zoning program on the streets and highways in Montana. This is in spite of

the fact that speed zoning has always been one of the most difficult and controversial functions of traffic operation and control. The difference of opinion between the people living along the highway on one hand and the motorists on the other, as to the proper speed limit, is quite understandable. Invariably the local residents feel that the speed zone should be set at a much lower speed than does the motorist and, consequently, the emotional involvement between these two factions makes it difficult to reconcile their differences satisfactorily. The magnitude of the area of conflict has been sharply accentuated by the growth in population and in motor vehicle registration which Montana has experienced since the passage of the first speed zone legislation.

The basic features of the speed zoning techniques originally adopted in Montana are still in use. This attests to the soundness of the methods originated by some of the pioneers in the Traffic Engineering field. However, during the last 35 years much has been learned about the proper usage of speed zones, and about the publicity and public relation aspect of speed zoning. It is this closer contact with the public through the press and radio which has been effective in gaining general acceptance of speed zoning and which has allowed increases, as well as decreases, of existing speed zones when the facts indicate that this is in order.

There is little doubt the present method of establishing speed zones in Montana gives results that are fair to the motorist, practical for the enforcement officer, and acceptable to the community.

A judicial appraisal of speed zoning practices on the street and highway system is not easy because of the complexity of the subject and because of the difficulty of evaluating, like all things pertaining to human behavior, the

exact effect of a speed zone can be difficult to define. However, a limited appraisal will be attempted by discussing first, the engineering aspects; second, the proper application of speed zones; and third, the procedures which are used to acquaint the public with speed zoning.

## ENGINEERING ASPECTS

The determination of the proper speed to use for any proposed speed zone hinges mostly on an engineering study which, for the purpose of this discussion, can be separated into: 1) the collection of the data, and 2) the analysis of the data.

### Collection of Data

The collection of data usually requires some field work to create a strip map and for spot speed checks of the existing vehicular flow. The accident data is available from the accident reports or the state computer system which have been created by the Montana Highway Patrol, Sheriff's, BIA and the City Police Departments.

**Strip Map:** The first step, usually, is the field work necessary to develop the strip map of the area to be speed zoned. A typical strip map is shown by Fig. 1. In some cases this information can be obtained from available maps. Another method of making strip maps is to use the information from aerial photographs, if they are available.

**Spot Speed Checks:** Spot speed checks at intervals of about 1,000 feet are taken during the daylight hours between the peak hours. Speed checks are taken under "average conditions" which is interpreted in Montana to mean that

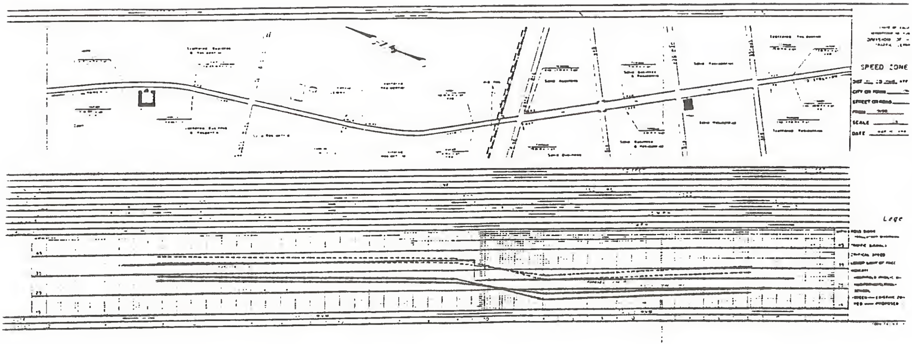



Fig. 1

the weather is good (dry pavement) and traffic conditions are normal. Speeds are checked by sampling approximately one or two hundred vehicles. The most common practice is to use radar. Only the free-flowing vehicles are included.

If the alignment is such that the speed at some locations is controlled by the curvature, then ball bank indicator studies of the curves to determine the safe driving speed should be included.

**Accidents:** The accident data for a three-year period is collected and plotted on the strip map according to whether they are fatal, injury or property damage only types.

## Analysis of Data

After the pertinent data has been collected, the following steps are taken: analyze the speed characteristics, calculate the accident rate, and evaluate the enforcement considerations.

## Statutory Requirements

**61-8-303. Speed restrictions -- basic rule.** (1) A person operating or driving a vehicle of any characteristic on a public highway of this state shall drive it in a careful and prudent manner, and at a rate of speed no greater than is reasonable and proper under the conditions existing at the point of operation, taking into account the amount and character of traffic, condition of brakes, weight of vehicle, grade and width of highway, condition of surface, and freedom of obstruction to view ahead, and he shall drive it so as not to unduly or unreasonably endanger the life, limb, property, or other rights of a person entitled to the use of the street or highway.

(2) Where no special hazard exists that requires lower speed for compliance with subsection (1) of this section, the speed of a vehicle not in excess of the limits specified in this section or established as authorized in 61-8-309, 61-8-310, 61-8-311, and 61-8-313 is lawful, but a speed in excess of those limits is unlawful:

(a) 25 miles per hour in an urban district;

(b) 35 miles per hour on a highway under construction or repair;

(c) 55 miles per hour in other locations during the nighttime, except that the nighttime speed limit on completed sections of interstate highways is 65 miles per hour.

(3) "Daytime" means from one-half hour before sunrise to one-half hour after sunset. "Nighttime" means at any other hour.

(4) The speed limits set forth in this section may be altered by the highway commission as authorized in 61-8-309, 61-8-310, and 61-8-313.

(5) The driver of a vehicle shall, consistent with subsection (1), drive at an appropriate reduced speed when approaching and crossing an intersection or railway grade crossing, when approaching and going around a curve, when approaching a hill crest, when traveling upon a narrow or winding roadway, and when a special hazard exists with respect to pedestrians or other traffic or by reason of weather or highway condition.

**61-8-306. Lower speed limits.** Nothing in 61-8-304 through 61-8-307 shall prohibit any state, county, municipal, or other local official, board, or body which has authority to enact laws relating to motor vehicle speed limits from establishing speed limits lower than that required by federal law on any public streets or highways as permitted by law on March 2, 1974.

61-8-309. **Establishment of special speed zones.** (1) If the department of highways determines upon the basis of an engineering and traffic investigation that a speed limit set by 61-8-303 is greater or less than is reasonable or safe under the conditions found to exist at an intersection, curve, dangerous location, or any other part of a highway under its jurisdiction, the commission may set a reasonable and safe special speed limit at that part.

(2) The department shall erect and maintain appropriate signs giving notice of these special limits. When they are erected, the limits are effective at that part at all times, or at other times the commission sets.

(3) The authority of the commission under this section includes the authority to set reduced nighttime speed limits on curves and other dangerous locations.

(4) This section does not authorize the commission to set a state-wide speed limit.

61-8-310. **When local authorities may and shall alter limits.** (1) If a local authority in its jurisdiction determines on the basis of an engineering and traffic investigation that the speed permitted under 61-8-303 and 61-8-309 through 61-8-313 is greater or less than is reasonable and safe under the conditions found to exist upon a highway or part of a highway, the local authority may set a reasonable and safe limit thereon which:

(a) decreases the limit at an intersection;

(b) increases the limit within an urban district, but not to more than 55 miles per hour during the nighttime; or

(c) decreases the limit outside an urban district, but not to less than 15 miles per hour.

(2) A board of county commissioners may set limits as provided in subsection (1)(c) without an engineering and traffic investigation on a county road, as defined in 60-1-103.

(3) A local authority in its jurisdiction shall determine by an engineering and traffic investigation the proper speed for all arterial streets and shall set a reasonable and safe limit thereon which may be greater or less than the speed permitted under 61-8-301 for an urban district.

(4) An altered limit established as authorized under this section is effective at all times or at other times determined by the authority when appropriate signs giving notice of the altered limit are erected upon the highway.

(5) The commission has exclusive jurisdiction to set special speed limits on all federal-aid highways or extensions thereof in all municipalities or urban areas. The commission shall set these limits in accordance with 61-8-309.

**Spot Speeds:** The field data is used to plot Cumulative Speed distribution curves for each direction of traffic at each speed check location. See Fig. 2. In addition, a determination is made of the average speed, the 85 percentile, and the pace speeds at each location. The pace speed is defined as the 10-mile increment speed containing the largest number of vehicles. Ordinarily 55 to 70 percent of the vehicles taken during a spot speed check fall within the 10-mile pace speed.

Fig. 2

The *cumulative frequency* diagram is prepared by plotting a graph with the class boundary of each class as the abscissa and the corresponding cumulative frequency of the class as the ordinate. The higher class boundary is matched with the corresponding cumulative frequency when the frequency summation is from the small to the large values of the study variable. However, the lower-class boundary is selected for this matching if the cumulative frequency is summed from the large to the small observations. A smoothed S-shaped curve is used to connect the plotted points between two extreme class boundaries having cumulative frequencies of 0% and 100%. Such a diagram is shown in Figure 17.4, using the data in Table 17-1. This curve is characteristic of the cumulative frequency for a normal distribution.

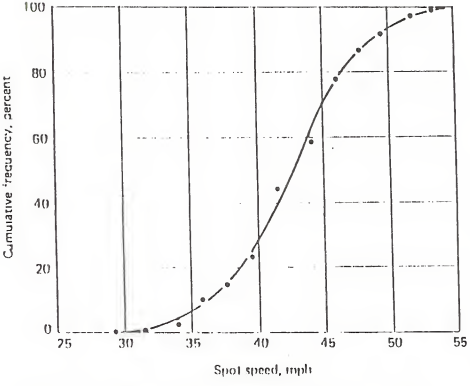



Figure 17.4. Cumulative frequency distribution of spot speeds (Rural area, two lane highway). Source: Paul C. Box and Joseph C. Oppenlander, *Manual of Traffic Engineering Studies*, 4th ed. (Arlington, Va.: Institute of Transportation Engineers, 1976), Fig. A-7.

The critical speed (85 percentile) and the lower limit of the pace for each direction for each speed check location are used to make a speed profile. See Fig. 3. Another very useful tool for analysis and evaluation of the spot speeds is a speed distribution diagram of each speed check. See Fig. 4. This also allows an instant evaluation to be made, when discussing a proposed speed zone with an officer or an interested official, of the percentage of the motoring public who would drive at speeds outside any proposed speed limit at that point.

**Accident Rate:** The accident rate per million vehicle miles is calculated for a three-year period for sections of the roadway which have similar characteristics and which have similar roadside development. This allows a comparison of the accident rate to be made to that of the state-wide average for comparable roads.

**Enforcement Considerations:** An important part of the job of establishing a speed zone is to present the engineering findings to the enforcement people in a clear and easily understandable way. It is a policy of long-standing by the State of Montana to obtain the concurrence of local jurisdictions on any proposed speed zone change. It has been found that this is not difficult if the factual data is presented properly because the facts speak for themselves. It is recognized that concurrence and support of enforcement officials is necessary for the successful operation of a realistic speed zone.

If the determination of the proper speed and of the length of a restricted speed zone is done carefully with full consideration to all pertinent facts, a logical and fair speed zone is created which obviously conforms to conditions. The reasonableness of such a zone is apparent to the average motorist and consequently the enforcement work is probably easier because there is likely to be less argument.

Instructions for Figure 3
(attached diskette)

ENGINEERING PROGRAMS

The diskette contains two programs which may be used for traffic engineering purposes. The first program is a speed survey program which calculates some statistics from a speed sample and prints a simple graph. The second program makes an estimate of gaps in vehicle flow based upon a vehicle count over a certain time span.

The diskette contains the necessary program files, but does not contain the BASIC language that is necessary in order for it to run. This is due to the fact that there are many versions of DOS available. You will need to copy your BASICA.COM file which is on your IBM or Microsoft DOS disk onto this diskette. At that time the diskette will be ready to run.

The program may be started by putting the diskette in drive A and turning on the computer. A menu will appear allowing you to choose between the speed sample and the gap module as shown below.

```
TRAFFIC ENGINEER PROGRAM MENU

0 ----- EXIT MENU
1 ----- SPEED MONITORING PROGRAM
2 ----- VEHICLE GAP PROGRAM
```

If you have a hard disk computer, you may make a directory and then copy the programs into that directory as shown below.

If you are in the root directory (C:\ or similar)
Type in MD ENGR press ENTER
Type in CD ENGR press ENTER

Copy files into the directory
Put our diskette in Drive A and type in:
COPY A:*.* press ENTER
Computer will copy 5 files into the ENGR directory.

BASICA.COM must be in this directory or a PATH statement must point to where BASICA.COM is located.

To start program from within the directory, type:
BASICA MENU-ENG press ENTER

If you have questions, call Harry Lauer 444-3412

SPEED SAMPLE ANALYSIS

Figure 4

LOCATION: COLUMBIA FALLS MEADOW LAKE BLVD. TEMPERATURE: 45
STATION: 1 CHECK START TIME: 1 PM
DATE: 11-21-89 END TIME: 3PM
COMMENTS: APPROX. 1000 FEET NO. OF US 2

15TH %: 31 SAMPLE SIZE: 63

MEDIAN: 39

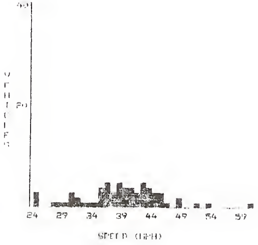
85TH %: 44

MEAN: 38.44 STAN DEV OF MEAN: 6.740

PACE: 35 - 44 CONTAINS 40 VEHICLES ACCOUNTING FOR 63.5%

| MPH | COUNT | CUMULATION | CUM PCT |
|---|---|---|---|
| 24 | 3 | 3 | 4.8 |
| 25 | 0 | 3 | 4.8 |
| 26 | 0 | 3 | 4.8 |
| 27 | 1 | 4 | 6.3 |
| 28 | 1 | 5 | 7.9 |
| 29 | 1 | 6 | 9.5 |
| 30 | 3 | 9 | 14.3 |
| 31 | 2 | 11 | 17.5 |
| 32 | 1 | 12 | 19.0 |
| 33 | 1 | 13 | 20.6 |
| 34 | 1 | 14 | 22.2 |
| 35 | 4 | 18 | 28.6 |
| 36 | 5 | 23 | 36.5 |
| 37 | 3 | 26 | 41.3 |
| 38 | 5 | 31 | 49.2 |
| 39 | 4 | 35 | 55.6 |
| 40 | 4 | 39 | 61.9 |
| 41 | 3 | 42 | 66.7 |
| 42 | 5 | 47 | 74.6 |
| 43 | 4 | 51 | 81.0 |
| 44 | 3 | 54 | 85.7 |
| 45 | 3 | 57 | 90.5 |
| 46 | 1 | 58 | 92.1 |
| 47 | 0 | 58 | 92.1 |
| 48 | 2 | 60 | 95.2 |
| 49 | 0 | 60 | 95.2 |
| 50 | 0 | 60 | 95.2 |
| 51 | 1 | 61 | 96.8 |
| 52 | 0 | 61 | 96.8 |
| 53 | 1 | 62 | 98.4 |
| 54 | 0 | 62 | 98.4 |
| 55 | 0 | 62 | 98.4 |
| 56 | 0 | 62 | 98.4 |
| 57 | 0 | 62 | 98.4 |
| 58 | 0 | 62 | 98.4 |
| 59 | 0 | 62 | 98.4 |
| 60 | 1 | 63 | 100.0 |

VEHICLE SPEED GRAPH



**Choice of Speed and Length of Zone:** After all of the facts pertaining to any proposed zone have been collected and analyzed, there still remains the final step of deciding on a proper speed or series of speeds. Usually many elements must be considered, such as alignment, grade, vertical curves, sight distance, width of traveled way, width of shoulder, parking, speed pattern, traffic volumes, pedestrian travel, type of pavement surface, accident picture, and roadside culture. The frequency of grade intersections and traffic signals are other very important considerations.

Obviously, no hard and fast rules can be laid down for the evaluation of the data which would allow a simple and straight-forward choice of a proper speed to be made. Experience has shown, however, that the prevailing speeds and the accident rate are of extreme importance and these two factors are given primary consideration.

The preferred speed is one that lies in the immediate vicinity of the 85 percentile. The permissible range is from the lower limit of the pace speed to the 85 percentile. It has been found that a speed limit set near a speed below which 85 percent of the traffic is moving is reasonable and safe for ordinary conditions and facilitates the orderly movement of traffic. Where there are unusual traffic or roadway conditions not readily apparent to the motorist, the speed limit may be set at a lower limit. However, these conditions are normally handled by applying other traffic control measures.

If the accident rate is higher than average, then this indicates that the choice of speed for the section of road in question might be lowered somewhat.

Experience has shown that speed zones, to be practical, must be at least 1000 feet long. This is the minimum length for 25 mph or 30 mph zones. 2500 foot minimum lengths are recommended for speeds of 45 mph or more.

The importance of carefully choosing reasonable beginning and end points for speed zones cannot be over-emphasized. These are generally located in the field after the strip map and spot speeds have been analyzed. Preferred location for the beginning and end points is where there are definite changes in the character of the roadside development. It is often desirable to choose to begin or end a speed zone so as to include an important road intersection. It has been found that it is best not to begin or end a speed zone in the immediate vicinity of adjacent school grounds.

A speed limit established according to these principles is not one person's idea or judgment, but is the consensus of those who drive the section of highway being zoned. The workability and soundness of this approach have been proven by 35 years of successful use.

## PROPER USE OF SPEED ZONING

If it is assumed now, for purposes of discussion, that the engineering work in connection with a proposed speed zone is handled carefully and intelligently, it is pertinent to consider what constitutes proper usage of this traffic control tool. To conscientious public officials this matter of proper usage is one of the most perplexing aspects of speed zoning because of the demand by well-meaning but uninformed people for speed zones where they are not needed or where no speed zone should ever be used. It is important to remember that speed zoning is essentially an enforcement aid and that it has no magical power to eliminate all troublesome friction and strife on the street or highway network. It is imperative, therefore, that every proposed speed zone be examined with regard to: 1) location, and 2) operation, so that

speed zones will be installed only at those locations where there is a problem to which a speed zone is applicable and would be of help in curbing the reckless and irresponsible driver.

Location of Speed Zone

Speed zoning on Montana streets and highways has generally been restricted to those locations which are urban or suburban in character. It is on highways that pass through this type of area that a problem is created because faster moving through travel conflicts with pedestrians, parking movements, and slower-moving vehicles on local trips.

**Small Communities:** The problem in smaller communities which straddle the highway is particularly difficult because oftentimes the motorists have been driving for long periods at sustained high speeds with the result that they pass through this type of community at a much faster speed than the local residents feel is proper.

**Urban and Suburban Areas:** Speed zoning in built-up areas serves an important function in that the motorists, through the speed limit signs, are reminded that they are approaching a section of highway where more than ordinary care is required. It is in this type of area that driving conditions are apt to change suddenly and without warning. For instance, there is a possibility that pedestrians may be poised at the side of the road preparing to cross. There is also a possibility that cross traffic may be encountered and that random vehicular movements may occur because of parking maneuvers and because of motorists entering and leaving driveways.

**Rural Locations:** Contrast to the conditions cited above with what a motorist may expect at remote rural locations with little or no roadside

development. Obviously, the need for speed zoning is nowhere near as great on a rural road. If there are alignment or grade characteristics which require more than usual care, the motorist can be alerted by the use of standard warning signs.

**Seasonal Conditions:** If a problem location on a highway is seasonal in character because of recreational aspects of a region, this fact must be carefully weighted in establishing the speed zone as there is a danger, in some cases, that the speed zone would not be appropriate for long periods.

**Transitional Speed Zones:** Indiscriminate use of transitional speed zoning is to be avoided because of the tendency, in some cases, to create long speed zones of doubtful value as a result of a traffic conflict on a relatively short section of road where there may be a genuine problem. In other words, short, reasonable speed zones are preferred.

## Speed Zone Operation

Speed zones require periodic review and observation to be sure that they function properly. Even the most warranted speed zone, established with due study and consideration, will fall into disrepute unless attention is given to enforcement, to periodic speed zone revision, and to sign and pavement marking maintenance.

**Enforcement:** Cooperation of enforcement officers is essential for the successful operation of a restricted speed zone.

**Maintenance:** Another important consideration is the proper maintenance of the signs and pavement marking which are used in conjunction with speed zones. In traffic engineering it is axiomatic that if signs and pavement markings are allowed to grow dirty and shabby, they quickly lose their

authority. In all fairness to the considerate and conscientious driver, speed limit signs should be of adequate size and prominently displayed in the standard positions so that they will catch the driver's eye, even though he is occupied with some of his other duties as a driver, as he passes through the area where the sign is located.

**Speed Zone Revision:** If a speed zoning program is to be effective, it is also necessary that there be a regular reexamination of existing speed zones to bring them in line with existing conditions. In Montana, for example, there are many locations where the roadside and general community development have changed in just a few years. As a result, modernization of the existing speed zone is necessary. To neglect this phase of the work creates a situation where public disrespect would be created if the out-of-line speed zones are not revised.

**Effect of Restricted Speed Zones:** Studies have shown that speed zoning has very little permanent effect on average vehicular speeds. There are indications, however, that it does have a tendency to group more of the drivers within the pace speed range through the fact that some of the slower drivers drive faster and some of the faster drivers drive slower after a realistic speed zone is established.

In some cases, it has been reported that speed zoning, under specific traffic and enforcement conditions, has had an effect in lowering the accident rate. However, this is unusual! Other types of traffic control devices that have proven to reduce traffic accidents should be applied first.

The principal benefit of properly established speed zoning is to provide a means for officers to apply enforcement to those that do not conform to speeds considered reasonable and safe by the majority of drivers.

## PUBLIC RELATIONS

Public understanding and acceptance of a speed zoning program cannot be obtained unless great care is exercised to set the actual speed restriction at a reasonable value. In addition to this primary requirement, it must be recognized that speed zoning is a cooperative project which includes the traffic engineer, the enforcement officer, and the judiciary. In other words, it is of vital necessity that these three groups have a full grasp of each other's problems with respect to speed zoning. The positive approach to obtain this understanding lies in personal contact between the individuals involved.

Good public relations in regard to speed zoning have been obtained through a three-step procedure which includes contact with the following: 1) enforcement personnel, 2) newspapers and radio people, and 3) public officials.

**Enforcement Personnel:** Many of the requests for speed zones and for speed zone revisions come from police officers or local officials. If the request is a written one, before any work is done, the Traffic Engineer, or one of his assistants, contacts the individuals involved and discusses the problem at hand with respect to their viewpoint and actual experiences along that section of highway. This also gives the traffic engineer a chance to air his problems and to explain the limitations within which they must operate. The individuals are then requested to formally approve the speed zone procedures and required to agree with the study results.

After all of the field work has been obtained and the data analyzed, another contact is made with the traffic officer or local official and the results of the study are discussed. An agreement is reached as to what speed restriction will be established. In the case of speed zones on state highways, this must be a tentative agreement because the speed zone must be submitted to the Helena Headquarters Office of the Department of Highways for commission approval.

**Publicity:** Publication of a speed zone change by the local media will alert the community to the change, and where necessary, an explanation may be given, such as, "the survey showed that the former speed limit was no longer applicable to present traffic conditions." Usually, however, the statement that an engineering and traffic study had been made is sufficient.

If the speed zone is one in which an existing speed restriction is to be raised, then a Traffic Engineer might contact the press representative in order that there be no misunderstanding as to our objectives.

**Public Officials:** It is particularly important that public officials be contacted before the study begins. In cases where it is probable that a question might be raised as to why a particular speed was chosen the public officials must be informed and in agreement with the changes. Oftentimes public officials assume that the power to establish speed zoning is arbitrary and that a lower speed would be desirable. Generally, this is on the assumption that a restricted speed zone will reduce the vehicular speeds.

When an explanation, before the study begins, is made as to how speed zones are established and how they operate, the average public official is generally reasonable and accepts the findings. Many times, however, a discussion of this kind leads to a request that these same facts be explained

to some local civic organization which has interested itself in the speed zone. The Traffic Engineer, or one of his assistants, should give freely of their time for this purpose. In some cases, actual demonstrations are given using radar, to show how the speeds are obtained.

Experience has shown that the lay audience can understand and appreciate the engineering approach to speed zoning when presented on a common-sense basis.

## CONCLUSION

Successful speed zoning is a cooperative project which includes the traffic engineer, the enforcement agencies and the judiciary. It requires careful engineering, conformance to recognized rules of usage, and development of public understanding and support. Under this approach, speed zoning is a valuable aid to the conscientious motorist and to the traffic officer.

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EXCERPTS FROM

MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES REGARDING SPEED ZONES

and

TRAFFIC CONTROL DEVICE HANDBOOK

(Manual on Uniform Traffic Control Devices Regarding Speed Zones)

**2B-10 Speed Limit Sign (R2-1)**

The Speed Limit sign shall display the limit established by law, or by regulation, after an engineering and traffic investigation has been made in accordance with established traffic engineering practices. The speed limits shown shall be in multiples of 5 miles per hour.

In order to determine the proper numerical value for a speed zone on the basis of an engineering and traffic investigation the following factors should be considered:

1. Road surface characteristics, shoulder condition, grade, alignment and sight distance.
2. The 85-percentile speed and pace speed.
3. Roadside development and culture, and roadside friction.
4. Safe speed for curves or hazardous locations within the zone.
5. Parking practices and pedestrian activity.
6. Reported accident experience for a recent 12-month period.

Two types of speed limit signs may be used: One to designate passenger car speeds including any nighttime information or minimum speed limit that might apply, and the other to show any special speed limits for buses and trucks. No more than three speed limits should be displayed on any one speed limit sign or assembly. Where a special speed limit applies to trucks or other vehicles, the legend TRUCKS 40, or such similar message as is appropriate, shall be shown below the standard message or on a separate plate (R2-2). When used independently, the Truck Speed sign should carry a reference to SPEED or MPH.

Minimum speeds shall be displayed only in combination with the posted speed limit (sec. 2B-12).

Advisory Speed signs are treated under section 2C-35.

The standard Speed Limit sign shall be 24 x 30 inches. On expressways the sign should be at least 36 x 48 inches, with 48 x 60 inches prescribed for use on freeways.

**2B-11 Night Speed Sign (R2-3)**

Where different speed limits are prescribed for day and night, both the limits shall be posted. This may be done in either of two ways:

1. Immediately below the standard Speed Limit sign (R2-1) or combined with it, a Night Speed sign (R2-3) carrying the legend NIGHT 45 (or other suitable numerical limit) may be erected. In this case the numerals in the Night Speed sign and only the words SPEED LIMIT in the standard sign, should

be reflectorized. As a special but logical exception to the general color scheme, the Night Speed sign should have its legend in white upon a black background.


R2-1
24" x 30"


R2-2
24" x 24"


R2-3
24" x 24"


R2-4
24" x 30"


R2-4a
24" x 48"

2. A changeable message sign may be used, so that only the appropriate regulation is visible at a given time. The sign may have interchangeable panels, or reflectorization of the nighttime speed superimposed over the unreflectorized numerals of the daytime speed, to permit only the nighttime speed to become legible in the beam of motor-vehicle headlamps at night.

### 2B-12 Minimum Speed Sign (R2-4)

Where an engineering and traffic investigation shows that slow speeds on a highway consistently impede the normal and reasonable movement of traffic, signs may be used to post a minimum legal speed. Driving slower than the minimum limit is illegal except when necessary for safe operation or in compliance with the law. The minimum speed shall be displayed only in combination with the posted speed limit and if desired, these two signs may be combined (R2-4a). The Minimum Speed sign shall have a standard, and a minimum, size of 24 x 30 inches.

(Traffic Control Device Handbook)

### 2A-3 Driver's Needs

To guide and operate a vehicle smoothly and safely, the driver must perceive the appropriate travel path while guiding and controlling his vehicle over the roadway. The driver must be able to see the sign, read the message, and understand its meaning before he can guide his vehicle along the proper path.

There are a number of factors that can interfere with or distract the driver from this seeing, reading, and understanding cycle. To begin with, all signs should be located where the driver will be able to see them while guiding and operating a vehicle. After the driver is aware of the sign's location, the driver must next be able to read the legend (letters, numbers, symbols, etc.) on the sign. Thus, the longitudinal and lateral position of the sign, and the legend style and size are critical.

To see the sign during periods of darkness, contrast is necessary. Contrast is a product of the brightness of the message on the sign panel in relation to the brightness of the background of the sign panel. This brightness is produced by the illumination from the vehicle's headlights or other illumination. For example, for a guide sign, the green sign background contrasts well with the light colored reflectorized letters or symbols.

The environment in which the sign is installed also affects the contrast. For example, in rural areas at night during clear weather, a standard reflectorized sign is highly visible since there is no environmental "clutter" to distract from the contrast of the sign. Conversely, in highly developed

urban situations, illuminated commercial signs and city street lighting can "wash out" sign contrast.

During daylight hours, the surrounding background is visible and competes with signs for driver attention. Consequently, the size, shape, and color of the sign are factors that contribute to the driver's ability to see the sign. Contrast during daytime is also important. The most common environmental backgrounds for a sign are the green of vegetation and the blue of the sky. For this reason, a border is placed around signs. With a border, signs show up as a geometrical shape, one that does not occur naturally. The geometrical shape provides the contrast between the sign and its environmental background.

When the eye is in a fixed position it is acutely sensitive within a 5 or 6 degree cone, but is satisfactorily sensitive up to a maximum cone of 20 degrees. It is generally accepted that all of the letters, words, and symbols on a sign should fall within a visual cone of 10 degrees for proper viewing and comprehension. This is roughly equivalent to the width of the hand (4 inches) held at arms length in line with the center of the road (Ref. 2-3).

After the driver sees the sign, he must understand its message and determine what action should be taken. To assist the driver in this task, the following factors should be considered:

- Comprehension -- The message should be logical, thus minimizing misinterpretation and ambiguity.

- Emphasis -- The more important information should be emphasized by size, location, or letter type.

- Expectancy -- The legend and its location must conform to the driver's expectation.

- Uniformity -- Similar types of information must be presented in a similar manner for similar decision situations.

- Sign Consistency - Similar types of information should be kept in the same general location on sign panels.

In the context of sign application, the "85th percentile speed" is the critical factor. This speed factor is defined as "that speed below which 85 percent of all vehicles travel and above which 15 percent travel." The 85th percentile speed is nationally recognized and accepted as the basis of posting speed limits unless there is a combination of unusual geometrics, high accident conditions, limited sight distance, or other extenuating circumstances.

The procedure for determining the 85th percentile speed is given in many engineering texts (for example, Ref. 2-4 and 2-5). Some of the key aspects involved in this procedure include:

- Methods for measuring speeds are varied and have inherent advantages and disadvantages. Commonly used methods include the radar meter, 20-pen graphic recorder, and enoscope (Ref. 2-6).

- The speed sample should be taken in good weather during off-peak hours to measure relatively free moving vehicles.

- The desired sample size is at least 100 vehicles. In rural areas and low volume roadways this may be difficult to achieve in a reasonable time period. The sample size may be lowered accordingly in these cases. Should this present a problem, the prevailing traffic speeds can be estimated by driving the route.

A sample study procedure to calculate the 85th percentile and average speeds is illustrated in Figure 2-4.

## Speed Study

| MPH | | | MPH | | | MPH | |
|---|---|---|---|---|---|---|---|
| 16 | | | 36 | 卌 I | (36 x 6 = 216) | 56 | |
| 17 | | | 37 | 卌 II | (37 x 7 = 259) | 57 | |
| 18 | | | 38 | 卌 | (38 x 5 = 190) | 58 | |
| 19 | | | 39 | IIII | (39 x 4 = 156) | 59 | |
| 20 | | | 40 | IIII | (40 x 4 = 160) | 60 | |
| 21 | | | 41 | III | (41 x 3 = 123) | 61 | |
| 22 | | | 42 | | | 62 | |
| 23 | | | 43 | | | 63 | |
| 24 | | | 44 | | | 64 | |
| 25 | | | 45 | | | 65 | |
| 26 | | | 46 | | | 66 | |
| 27 | | | 47 | | | 67 | |
| 28 | | | 48 | | | 68 | |
| 29 | | | 49 | | | 69 | |
| 30 | 卌 II | (30 x 7 = 210) | 50 | | | 70 | |
| 31 | 卌 III | (31 x 8 = 248) | 51 | | | 71 | |
| 32 | 卌 卌 卌 卌 | (32 x 20 = 640) | 52 | | | 72 | |
| 33 | 卌 卌 卌 卌 II | (33 x 22 = 726) | 53 | | | 73 | |
| 34 | 卌 卌 卌 II | (34 x 17 = 578) | 54 | | | 74 | |
| 35 | 卌 卌 II | (35 x 12 = 420) | 55 | | | | |

MUNICIPALITY CITY OF ANYTOWN

DATE 8-8-80 TIME 10:30 AM - 11:45 AM

LOCATION "A" STREET BETWEEN 10TH & 11TH STREETS

DIRECTION OF CLOCKED VEHICLE NORTHBOUND

WEATHER CLEAR ROAD CONDITION DRY

RECORDER JOE DOE 85 PERCENTILE 37 M.P.H.

Total Vehicles = 115
85% Tol. Veh. = 97.75 say 98
85% Speed = 37 mph

Total Vehicle M.P.H. = 3926
3926 ÷ 115 = Avg. Spd. 34 m.p.h.

### Procedures

1. Add up the number of vehicles for each individual speed and place it at the extreme right end of the line for that particular speed.

2. Add up the total number of vehicles for all speeds.

3. Multiply the total number by 0.85.

4. The total determined in # 3 is the number of vehicles traveling at the 85 percentile speed or less.

5. Beginning at the lowest recorded speed, begin adding up the individual number of vehicles until the total in # 4 is reached. The speed to the left of this number is the speed at which 85 percent of the total number of vehicles are traveling at or less.

**Figure 2-4 Sample Speed Study**

HIGHWAY SAFETY ENGINEERING STUDIES

FEDERAL HIGHWAY ADMINISTRATION

NATIONAL HIGHWAY INSTITUTE REGARDING SPEED ZONES

PROCEDURE 8 Spot Speed Study

## Purpose

Spot speed studies are used to determine the speed distribution of a traffic stream at a spot location.

## Application

A number of characteristics are commonly determined in spot speed studies. They include:

- Median Speed (50th percentile) - The middle value in a speed distribution pattern, i.e., one-half of the observed values are higher than the median and one-half are lower.

- Modal Speed - The speed (or range of speeds) at which the greatest frequency of observations occurs.

- 85th Percentile Speed - The speed within a distribution at or below which 85 percent of the vehicles travel and above which 15 percent travel.

- Skewness - The tendency of a speed distribution to favor a particular speed range. It is used to identify the overall speed tendencies of a speed study sample.

- Pace - The 10 mile per hour range in speeds containing the highest number of recorded observations. The pace is used in identifying the range of speeds for the sample.

- Need for Spot Speed Study

The spot speed study may be performed because of information from (1) the accident procedures, (2) the field review, (3) complaints made by citizens or (4) other conditions which warrant a review of the "safe approach or travel speed" of the traffic. Typical accident patterns and possible causes indicating the need for a spot speed study are shown in Table 16:

- Use of Spot Speed Characteristics

Spot speed studies are useful for:

- Determining and justifying the need for countermeasures, such as the posting of advisory speed indicators at curves.

Table 16. Accident patterns relating a need for a Spot Speed Study.

| Situation | Pattern | Possible Cause |
| --- | --- | --- |
| Signalized Intersection | o Right-angle accidents<br><br>o Left-turn accidents<br><br>o Rear-end accidents | o Short amber phase or high travel speed.<br><br>o Short amber phase or high travel speed.<br><br>o Long amber phase. |
| Unsignalized Intersection | o Right-angle accidents<br><br>o Left-turn accidents | o Insufficient sight distance or high travel speed. |
| Curve section of roadway | o Head-on, run-off-road, or fixed object accident. | o High travel speed. |
| Any location | o High severity characteristics. | o High travel speed. |

- Relating to other traffic variables such as capacity information.

- Evaluating locations or studying sites to determine the effect of changes in traffic control or conditions.

- <u>Period of Data Collection</u>

The study period for performing a spot speed study is dictated by the "time of day" accident patterns at the site. For example, if a pattern of accidents is indicated during a specific time period, this period should be used for performance of the spot speed study.

It is important that studies be performed in favorable weather and typical traffic conditions, except where special studies dictate the performance of a study under special conditions.

- Sample Size Determination

Prior to performing a spot speed study, it is necessary to determine the sample size required to depict the existing conditions accurately.

The minimum sample size [1] is determined by the following formula:

$$N = (SK/E)^2$$

Where:

N = minimum sample size

S = sample standard deviation (mph or kph)

K = constant relating to the desired confidence level

E = permitted error in the speed estimate (mph or kph)

If the standard deviation, S, has not been determined prior to the study, an estimated value should be used. Table 17 contains sample standard deviations, classified by highway area and type, which are based on past research and experience [1].

If the specific field conditions of the study area are not included in the below table, the "Rounded Value" may be used.

Table 17. Standard deviations of spot speed for sample size determination.

| Highway Area | Highway Type | MPH | KPH |
|---|---|---|---|
| Rural | Two-lane | 5.3 | 8.5 |
| Rural | Four-lane | 4.2 | 6.8 |
| Intermediate | Two-lane | 5.3 | 8.5 |
| Intermediate | Four-lane | 5.3 | 8.5 |
| Urban | Two-lane | 4.8 | 7.7 |
| Urban | Four-lane | 4.9 | 7.9 |
| Rounded Value | | 5.0 | 8.0 |

Generally, a confidence level of 95.0% (K = 1.96) is used for most traffic engineering purposes. For special cases, a greater confidence level may be required. Commonly used confidence levels and their respective "K" values are:

| Confidence Level (%) | K |
|---|---|
| 68.3 | 1.00 |
| 90.0 | 1.64 |
| 95.0 | 1.96 |
| 99.0 | 2.58 |
| 99.7 | 3.00 |

The permitted error, E, generally ranges from $\pm$ 1.0 mph (1.5 kph) to $\pm$ 5.00 mph (8.0 kph). The selected "permitted error" is based on the importance of the accuracy of the results. A low permitted error should be used for safety studies.

A general rule-of-thumb for sample size determination is to use a minimum sample of 100 vehicles.

## Example

A spot speed study is to be performed at an isolated curve to determine driver conformance to the posted speed limit. The study is warranted because a pattern of run-off-road accidents has been identified. The minimum sample size was computed using the previously defined criteria:

S = 5.3 mph (8.5 kph)

K = 1.96 (confidence level of 95.0 percent)

E = $\pm$ 1.0 mph (1.6 kph)

English

$$N = \frac{5.3 \times 1.96}{1.0}^{2} = 108;$$

Metric

$$N = \frac{8.5 \times 1.96}{1.6}^{2} = 108$$

- Performance Guidelines

To depict an unbiased and accurate estimate of spot speed data at a location, several general rules should be followed:

1. Equipment should be concealed from the approaching driver;
2. The observer or the data recorder should be as inconspicuous as possible;

3. Onlookers should be avoided;
4. An adequate sample should be obtained;
5. The lead vehicle in a queue should preferably be sampled to obtain a more representative sample of free flowing vehicles;
6. Select trucks for speed observation in proportion to their presence in the traffic stream; and
7. Avoid sampling a large proportion of high and low speed vehicles.

Speed Study Techniques

Four principal methods of data collection are available to obtain spot speed data. They include:

- Doppler Meter.
- Stop watch method.
- Electric or electronic methods.
- Photographic techniques.

Primary considerations for these techniques are given in Table 18.

- Doppler Meter

Meters based on the Doppler principle [2,3,4] utilize reflected electromagnetic or sound waves to detect vehicle speeds. Two meter types are typically used: radar and sonic. The radar meter [2,3] is usually operated by trained personnel in accordance with the manufacturer's specifications and procedures. It can be operated from a mobile battery pack or plugged into a vehicle power source (cigarette lighter, etc.). Prior to recording data, a tuning fork is used to calibrate the meter.

In operating the meter, the observer is situated in an inconspicuous manner on the side of the road. The operator directs the meter at the desired vehicle, attempting to keep the angle between the vehicle's direction of travel and the line of sight of the meter as small as possible. This practice minimizes the error in the meter reading. The meter displays the speed of the vehicle, which is then recorded on a data sheet. This process is continued until the minimum sample size is obtained.

The ultrasonic meter method [3,4] utilizes an overhead, transmitter-receiver. The meter is directed toward approaching traffic and records the sound wave reflections. In many cases the data are relayed (via telephone lines or other transmission equipment) to a central location, where they are recorded on data sheets.

Advantages:

1. Set-up and operation is simple for radar method.
2. Can produce reliable results.
3. Equipment has high service life.

Table 18. Primary considerations for Spot Speed Study techniques.

| Technique | Function | Equipment Requirements | Manpower Requirements | Time Requirements | Associated Costs | Data Input | Data Obtained | Data Output |
|---|---|---|---|---|---|---|---|---|
| 1. Stop Watch Methods | .Manually records time for vehicle to traverse a specified distance | .Stop watch<br>.Dependent on method used:<br>-flashing lights, or<br>-enoscope, or<br>-speed watch<br>.Pneumatic tubing or electrical cable | One observer (technician) per direction | .Dependent on required sample size and traffic volume at study location | .Stop watch $30-$200<br>.Speed watch $150-$300<br>.Enoscope $100 | .Defined location<br>.Accident summary data<br>.Travel course length | .Time (seconds) to traverse course length | .Travel (spot) speed at study location |
| 2. Electric or Electronic Methods | .Mechanically records time for vehicle to travel a short specified distance | .Relay device (road tubing, tapeswitch, etc)<br>.Recording device (meter) | .One observer (technician) per direction<br>.Technician to set up equipment | .15-30 minutes per site to set up equipment<br>.Recording time dependent on sample size required and traffic at specific location | .Meters and miscellaneous equipment range from $200-$2000 | .Defined location<br>.Travel course length<br>.Accident summary data | .Time (seconds) to traverse course length | .Travel (spot) speed at study location |
| 3. Photographic Techniques | .Manually records or computes time for a vehicle to traverse a specified section of roadway using photographic techniques | .Camera<br>.Airplane (if aerial means used) | .Technician to set up camera<br>.Pilot (if aerial means used)<br>.Technician to check camera during operation<br>.Technician or engineer to review, record, or compute data | .Camera set up time - 30-60 minutes per camera<br>.Technician equipment check varies with distance of location from office<br>.Data review and analysis time dependent on study period | .Camera equipment $500 - $2000 | .Defined location<br>.Travel course length<br>.Accident summary data | .Time (seconds) to traverse course length | .Travel (spot) speed at study location |
| 4. Meters Using Doppler Principle | .Provides spot speeds using radar techniques | .Radar gun | .Technician to operate radar meter | .Dependent on sample size and traffic volume in study area (time is usually less than with other techniques) | .Radar gun $500-$1500 | .Defined location<br>.Accident summary data | .Spot speed at location | .Spot speed at location |

4. Typically permits sampling of high percentage of vehicles in a relatively short amount of time.

Disadvantages:

1. Experienced or FCC certified data collectors are required.
2. Difficult to distinguish a single vehicle being observed in heavy and/or multi-lane traffic.
3. For sonic meter, equipment is costly.
4. For sonic meter, renting or buying of a data transmission means is required.

The radar meter is the most widely used method of obtaining speed data. It is appropriate for most situations because of its low cost, ease of use, and the capability to obtain a large sample in a relatively short amount of time. Sonic meters are infrequently used due to the lack of available equipment.

- Stop Watch Method

The stop watch method [2-7] estimates vehicle speed from the measured time required for a vehicle to travel over a defined distance. In this method, a measured course is laid out at the study location. Recommended course lengths are dependent on the estimated travel speeds along the roadway. Typical course lengths are given in Table 19.

In some cases, the course length is laid out in lengths such as 100 feet, 100 meters, etc. For time measurement and accuracy purposes, these distances should be set, so that the minimum time to traverse the course will not be less than 1.5 seconds. A 2.0 - 2.5 second target value is preferred.

Table 19. Recommended course lengths for Spot Speed Studies using stop watch methods.

| Estimated Average Speed of Traffic Stream | | Course Length | |
|---|---|---|---|
| mph | kph | ft. | m |
| less than 25 | less than 40 | 88 | 25 |
| 25-40 | 40-65 | 176 | 50 |
| more than 40 | more than 65 | 264 | 75 |

Source: Transportation and Traffic Engineering Handbook

Pavement markings or identifiable reference points are used to define the course limits. These markings or points should be easily visible by the observer from his vantage point.

Techniques available to assist in timing vehicles include:

- An observer method.
- The use of an enoscope.
- The use of flashing lights.

In the observer technique, an observer is positioned midway between the reference markings. As the front wheels of a vehicle cross the reference marks, the observer actuates a stop watch. The watch is stopped the instant the vehicle passes the second reference point. The stop watch reading is then recorded on a data sheet.

Using an enoscope[1], the observer is situated at one end of the course. The enoscope, placed at the other end, provides a flash of light as the vehicle passes the reference point. A stop watch is used to record the elapsed time. The stop watch reading is then recorded on a data sheet.

In the flashing lights technique, a detection and switch device, such as pneumatic road tubing, tapeswitches, or electrical conduit is positioned at one end of the course. The device is connected to a set of flashing lights. As a vehicle passes the reference point, the lights are actuated. The observer stationed at the other reference point measures the starting and ending times. The stop watch reading is then recorded onto a data sheet.

The readings obtained by these techniques are recorded onto a data sheet similar to the one shown in the Appendix.

Advantages:

1. Requires minimal set-up time.
2. Has low or no maintenance costs.
3. Equipment costs can be low.
4. Operation is simple.

Disadvantages:

1. May result in timing inaccuracies due to inappropriate vantage points.
2. Human bias may affect timing of vehicles.
3. Visibility of relay or recording devices along the roadside may result in atypical driving patterns.

---

[1]An enoscope is an L-shaped box, opened at both ends, with a mirror set at a 45 degree angle to the arms of the device, permitting a flash of light to be emitted as a vehicle passes the device.

The stop watch methods are appropriate for most situations. Prior to the use of radar meters, such methods were commonly employed for spot speed studies. Where equipment resources are minimal, these methods provide a reliable measurement of spot speeds.

- Electric and Electronic Methods

The electric and electronic methods [3,4,7-11] utilize detection and relay devices such as: pneumatic road tubes, tapeswitch, magnetic tapes, etc., positioned within the roadway and interfaced to electric or electronic recording devices. In most of these methods, vehicle travel times over a measured course are used to define the spot speed. The course length may be as short as 6 to 15 feet, depending on the expected travel speeds. The course is bounded by switch devices installed on the roadway, which transmit the vehicle travel times to a recording device or recording meter located along the side of the road.

Techniques for measuring the travel time include:

- Pen graphic recorder.
- Speed watch.
- Electrically operated meter.
- Electronic meter.
- Mobile traffic data collection system.
- Electronic decade meter.
- Magnetic loop detectors.

The pen graphic recorder utilizes either pneumatic road tubes or tapeswitches positioned at the beginning and end points of the travel course. As a vehicle passes the starting point, indicator marks are automatically recorded on a chart (moving at a constant speed) for each axle on the vehicle. When the vehicle passes the end point, another set of indicator marks is generated by the same pen. The speed of the vehicle is determined by the distance between the two sets of marks.

In the speed watch method, the timing of a vehicle is obtained automatically.[2] The speed watch is connected to roadway detection and switch devices located at the beginning and end of the course. As a vehicle passes the starting point, the speed watch is actuated. The watch is automatically stopped as the vehicle passes the end point. The reading on the speed watch is recorded onto a data sheet by an observer who also resets the device.

The electric and electronic decade meters are similar to the speed watch. Pneumatic road tubes actuate the electric meters while tape-switches are used in relaying information to the electronic decade meter. Calibrated speed readings are recorded from these devices.

---

[2]A speed watch is a calibrated timing unit operated by road tube or electrical impulses.

Mobile traffic data collection systems and magnetic loop detectors are similar in that both are able to obtain speed data by measuring the time it takes a vehicle to pass a predefined loop length. Such information is relayed to a roadside recording device where it is recorded on magnetic tape or on printed or punched tape. These methods can also be used to obtain other traffic variables, such as: volume, space headway, and time headway.

Advantages:

1. Reduced human error and bias.
2. Can be simple to operate.
3. Produces reliable measurements.
4. Collects a large number of measurements in a relatively short amount of time.

Disadvantages:

1. Detection devices located on the roadway may influence driver behavior.
2. Requires frequent calibration of devices due to weather changes.
3. Equipment costs may be considerable.

These techniques are more accurate than the stop watch method. The lack of equipment usually limits their use, however. Where equipment is available, this technique is appropriate for most highway locations.

- Photographic Techniques

Photographic techniques [12] utilize distance and time relationships to obtain speed information. Means of performing photographic surveys include time-lapse and continuous film photography. Steps for these techniques are similar to those described in Procedure 7 - "Volume Study". Advantages, disadvantages, and limitations are also similar. This technique is generally limited to use where other traffic variables are being studied.

## Selection of Techniques

In selecting techniques for performing a spot speed study, it is necessary to consider the management concerns. These concerns include: equipment, time, and manpower requirements, the data collection capabilities, and the accuracy of each technique. Table 20 displays the utility of each spot speed study technique as a function of these management concerns.

General guidelines to use in selecting a technique are:

1. For most highway safety applications, the use of a radar meter is preferred. Costs of a radar meter ($500 - $1500) can be moderately higher than some of the other techniques. The flexibility, ease of use, and overall efficiency of the radar meter make it a desirable technique.

Table 20. Technique utility for Spot Speed Study.

| Technique / Management Concern | Stop Watch Method | Electric or Electronic Methods | Photographic Techniques | Doppler Principle Methods |
|---|---|---|---|---|
| .Time Requirements | .Requires short equipment set up and data collection effort<br>.Requires substantial data manipulation effort | .Requires substantial equipment set up effort<br>.Uses short data collection effort<br>.Uses short data manipulation effort | .Requires substantial equipment set up effort<br>.Uses short data collection effort<br>.Requires substantial data extraction effort<br>.Requires substantial data manipulation effort | .Uses short data collection and manipulation effort |
| .Equipment Requirements | .Stop watch<br>.Other needs minimal | .Detection devices<br>.Electric or electronic meters | .Photographic equipment | .Radar meter |
| .Manpower Requirements | .Technician level | .Technician level | .Technician level | .Technician level |
| .Data Collection Capabilities | .Indirectly obtains speed data | .Most methods directly obtain speed data | .Indirectly obtain speed and other traffic variables | .Directly obtains speed data |
| .Level of Accuracy | .Accurate | .Highly accurate (dependent on maintenance of equipment) | .Accuracy limited by vantage point of camera | .Accurate for most purposes |

2. Where radar equipment is unavailable, stop watch methods are acceptable.

3. If greater accuracy is desired, the electric or electronic methods are required. Where available, magnetic loop detectors produce highly reliable results.

4. Photographic techniques are discouraged except where other traffic variables are to be measured.

Findings

The tabulation and output of the spot speed data are usually presented on data sheets as shown in the Appendix.

In the stop watch methods, several of the electric and electronic methods, and photographic techniques, the data obtained are typically in the form of the travel time data required to pass over a defined course length. In this form, the data must be transformed into speed information by dividing the recorded travel time into the course length.

- Use of Findings

In cases where high travel speeds are noted as a "possible accident cause", the speed characteristics are directly compared to the speed limits and conditions at the study site. Where travel speeds are determined to be higher than is reasonably safe for field conditions, a reduction in travel speeds, a change in geometrics or field conditions, or advance warning of vulnerable conditions are feasible alternatives. Where insufficient sight distance exists, the sight obstruction may be removed, or approach speeds reduced.

Finally, spot speed data can also be used to compare the effectiveness of an improvement using speed as a measure of effectiveness in a before/after study. Evaluation studies are covered in detail in the Evaluation Component of HSIP.

- Example

The following example is for a spot speed study conducted with the stop watch method over a course length of 176 feet (52.8 m). From the data shown in Figure 18, the following characteristics were calculated.

Median speed - (50th percentile) - Obtained by manually counting the vehicle groups to depict the speed at which fifty percent (or 54 vehicles) of the vehicles travel at a higher rate. In this case, the median speed is 37.5 mph.

# SPOT SPEED STUDY
## FIELD SHEET

Date 8/25/80 Location RUSSELL ROAD Direction NB
Time 10-11 AM Weather CLEAR Road Surface Condition DRY

| SECONDS | mph for 88 ft | mph for 176 ft | | PASSENGER VEHICLES | No. veh | BUSES | No. veh | TRUCKS | No. veh | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 60.0 | 120.0 | | | | | | | | |
| 1.2 | 50.0 | 100.0 | | | | | | | | |
| 1.4 | 42.8 | 85.7 | | | | | | | | |
| 1.6 | 37.5 | 75.5 | | | | | | | | |
| 1.8 | 33.3 | 66.6 | | | | | | | | |
| 2 | 30.0 | 60.0 | | II | 2 | | | | | |
| 2.2 | 27.2 | 54.5 | | | | | | | | |
| 2.4 | 25.0 | 50.0 | | III | 3 | | | | | |
| 2.6 | 23.0 | 46.1 | | IIII | 5 | | | | | |
| 2.8 | 21.4 | 42.8 | | IIII IIII III | 13 | | | I | I | |
| 3 | 20.0 | 40.0 | | IIII IIII IIII IIII IIII | 25 | | | | | |
| 3.2 | 18.7 | 37.5 | | IIII IIII IIII IIII I | 21 | | | | | |
| 3.4 | 17.6 | 35.2 | | IIII III | 8 | | | | | |
| 3.6 | 16.6 | 33.3 | | IIII IIII IIII II | 17 | | | I | I | |
| 3.8 | 15.7 | 31.5 | | IIII III | 8 | | | | | |
| 4 | 15.0 | 30.0 | | III | 3 | | | | | |
| 4.2 | 14.2 | 28.9 | | | | | | | | |
| 4.4 | 13.6 | 27.2 | | I | 1 | | | | | |
| 13 | 4.6 | 9.2 | | | | | | | | |
| 14 | 4.2 | 8.5 | | | | | | | | |
| 15 | 4.0 | 8.0 | | | | | | | | |
| | | | TOTAL VEHICLES | | 106 | | | | 2 | 108 |

Figure 18. Spot speed study data-example.

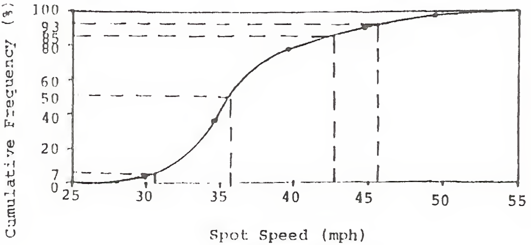



Figure 19. Graphical summary of spot speed data.

Modal Speed - Obtained by manually counting and selecting the vehicle speed group with the greatest number of observations. In this case, the modal speed would be 40.0 mph (25 observations).

85th percentile speed - Obtained by manually counting the vehicle groups to depict the speed at which 15 percent (or 16 vehicles) of the vehicles travel at or higher. In this case, the 85th percentile speed is 42.8 mph.

Skewness - Obtained by dividing $2(S_{93} - S_{50})$ by $(S_{93} - S_7)$.

$$\frac{2(46.1 - 37.5)}{(46.1 - 31.5)} = \frac{17.2}{14.6} = 1.18$$

A skewness of 1.0 indicates symmetry of the speeds about the mean speed. A value below 1.0 shows skewness towards the lower speeds, indicating a greater tendency of lower travel speeds along the study section. A higher value indicates higher travel speeds. In the example noted above, the distribution shows skewness towards the higher speed ranges which indicates more free flowing uncongested conditions.

Pace - Obtained by manually counting the vehicles in each speed group to represent the greatest number of observations within a 10 mph range. In the example, the pace occurs in approximately the 33-43 mph range with 84 of 108 observations in this range. It indicates a narrow range of travel speeds by the sample traffic which is a favorable safety condition. A wide range usually indicates more hazardous conditions, caused by differences in travel speeds between vehicles.

The spot speed findings can be obtained using a graphical approach as shown in Figure 19. This plot visually displays the speed distribution pattern of the traffic. On one axis, the range of spot speeds is displayed. The other axis records the cumulative frequency of observations within the defined speed ranges. The key spot speed characteristics can be obtained from, and are shown on the graph. The data reveal a narrow distribution of speeds along the study area.

Another speed characteristic often used by traffic engineers is speed variance. The variance is obtained by squaring the standard deviation of the speeds. For optimum safety conditions, the variance should be less than 1.0. It has been shown by several researchers that accident involvements increase significantly when large deviations from the mean speed occur.

## PROCEDURE 9 Travel Time and Delay Study

Travel time and delay studies are normally grouped into two areas:

- Link studies.
- Intersection studies.

Each study serves a unique purpose and has differing criteria regarding its performance. This section will discuss these studies.

## - Link Studies

### Purpose

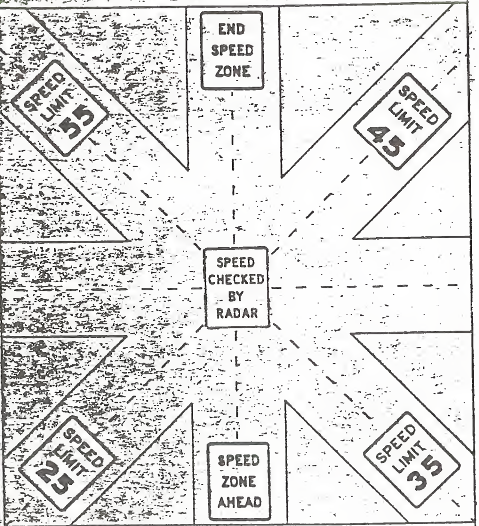
Link travel time and delay studies are used to obtain data on the amount of time it takes to traverse a specified section of roadway and the amount, cause, location, duration, and frequency of delays occurring during the trip. Travel time and delay characteristics are indicators of the level of service of a facility. They can be used as a relative measure of efficiency of traffic flow.

# REALISTIC SPEED ZONING IN MONTANA

An Informational Report

# Realistic Speed Zoning in Montana

An Informational Report




Prepared by Traffic Unit

Montana Department of Highways

January, 1977

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## INTRODUCTION

This manual is written as a practical guide to realistic speed zoning for those who are unfamiliar with engineering and traffic studies as conducted by the Montana Department of Highways.

Montana law provides for establishment of safe and reasonable speed limits, by the Highway Commission, for all Federal-Aid highways including those portions within cities or urban areas. Speed limits are to be based on an engineering and traffic investigation and are applicable for special zones or sections of streets or highways, where the general statewide statutory speed limits do not fit the road and traffic conditions (Sections of the law re: speed zones are 32-2144, 45, 46 and 47). The Manual on Uniform Traffic Control Devices, as adopted by the Montana Highway Commission, is used by Montana as a standard for establishing speed zones, placing signs, signals and pavement markings, and the numerous other devices needed for traffic guidance and controls.

The first part of this pamphlet discusses why speed limits should be reasonable and why they are based on an engineering and traffic investigation. The last part tells how an engineering and traffic investigation is conducted.

### SPEED ZONING - WHY?

#### Fundamentals of Realistic Speed Zoning

Most citizens will behave in a reasonable manner as they go about their daily activities. Many of our laws reflect observations of the way reasonable people behave under most circumstances. Traffic regulations are also based upon the observations of the behavior of groups of reasonable motorists under various conditions. Generally speaking, traffic laws which are based on the behavior of reasonable motorists are found to be successful. Laws that arbitrarily restrict the majority of drivers encourage wholesale violations, lack public support and usually fail to bring about desirable changes in driving behavior. This is especially true of speed zoning.

Speed zoning is based upon some concepts which are deeply rooted in our american system of government and law:

1. Driving behavior is an extension of our social attitude, and the majority of our drivers respond in a safe and reasonable manner as demonstrated by their good driving records.

2. The careful and competent actions of a reasonable person should be considered legal.

3. Laws are established for the protection of the public and the regulation of unreasonable behavior of an individual.

4. Laws cannot be effectively enforced without the consent and voluntary compliance of the public majority.

Public acceptance of these precepts is normally instinctive. However, the same public, when emotionally aroused in a specific instance, will invariably reject these fundamentals and rely instead on more comfortable and widely held misconceptions, such as:

1. Speed limit signs will slow the speed of traffic.

2. Speed limit signs will decrease the accident rate and increase safety.

3. Raising a posted speed limit will cause an increase in the speed of traffic.

4. Any posted speed limit must be safer than an unposted speed limit, regardless of traffic and roadway conditions prevailing.

Before and after studies consistently demonstrate that there are no significant changes in traffic speeds following the posting of new or revised speed limits. Furthermore, no published research findings have established any direct relationship between posted speed limits and accident frequency, although short term reductions have resulted from saturation enforcement efforts directed at speed and other traffic law violations.

Police agencies necessarily rely on reasonable and well recognized speed laws to control the unreasonable violator whose behavior is clearly out of line with the normal flow of traffic.

<u>Why Are Realistic Speed Zones Desirable?</u>

Realistic speed zones are of importance for a variety of reasons:

1. They satisfy the requirements of the state law for establishing prima facie speed limits on public streets and highways.

2. They invite public compliance by conforming to the behavior of the majority and by giving a clear reminder to non-conforming violators.

3. They offer an effective enforcement tool to the police by clearly separating the occasional violator from the reasonable majority.

4. They tend to minimize current public antagonism toward police enforcement of obviously unreasonable regulations.

5. They inject an element of logic and reason into an otherwise arbitrary and often emotional issue.

6. They correctly serve to place responsibility for justifying so-called "tolerances" upon those administrative agencies that grant them.

7. They lend credence and acceptability to the widely posted admonition "Speed Checked by Radar" at many city boundaries.

## Where Are Realistic Speed Zones Applicable?

Establishment of safe and realistic speed limits for certain special zones or sections of street or highway, where the general state-wide statutory speed limits do not fit the road and traffic conditions, is often necessary. Various locations at which speed zoning is commonly warranted include:

1. Transitional stretches of roadway, from rural to urban conditions.

2. Unusual roadway conditions. or other features which make it advisable to establish speed limits different from those applicable under general laws. Such conditions would include winding sections of roadway, sharp curvature, steep downgrades, restricted sight distance or view obstructions, restricted lateral clearance, poor surface conditions and other dangerous locations.

3. Intersection approaches, particularly where view obstructions exist.

4. Highways and streets which have design standards considerably higher or lower than other highways in the state or community involved. Such examples are freeways, expressways, urban extensions of primary state highways, major streets and arterials.

5. Temporary zoning at construction sites.

The basic intent of speed zoning is to influence as many drivers as possible to operate at or near the same speed - thus reducing conflicts created by wide differentials in operating speeds.

## What Does the Law Require?

The Montana Vehicle Code reflects the sensible viewpoint that speed zoning, as other types of traffic control, is based on traffic conditions and natural driver behavior - and not simply upon a hasty or arbitrary response to a traffic event.

## Basic Speed Law

All fifty states base their speed regulations on the Basic Speed Law:

> "No person shall drive a vehicle upon a highway at a speed greater than is reasonable or prudent having due regard for weather, visibility, the traffic on, and the surface and width of, the highway, and in no event at a speed which endangers the safety of persons or property."

This law recognizes that driving conditions vary widely from time-to-time and place-to-place. No set of fixed driving rules will adequately serve all conditions. The motorist must constantly adjust his driving behavior to fit the conditions he meets. He must learn to do this with a minimum of assistance from the police. The basic speed law is founded on the belief that most motorists are able to modify their driving behavior properly, as long as they are aware of the conditions around them.

## Absolute Speed Limit

Montana has speed limits above which it is always illegal to drive, regardless of the conditions. This type of speed limit allows no questions as to whether or not the driver was proceeding at a safe speed when he exceeded the speed limit. Advantages of absolute speed limits are their clarity of meaning, and the comparative ease with which verdicts can be reached.

## Intermediate Speed Limit

Montana law permits the Highway Commission to establish speed limits on all Federal-Aid highways or extensions thereof in all municipalities or urban areas. These speed limits shall be determined on the basis of an engineering and traffic investigation. These intermediate speed zones are the subject of this manual.

# SPEED ZONING - HOW?

## Engineering and Traffic Investigation

As defined in the Manual on Uniform Traffic Control Devices, an engineering and traffic investigation should include consideration of the following items:

1. Road surface characteristics, shoulder condition, grade, alignment and sight distance.

2. The 85th percentile speed and pace speed.

3. Roadside development and culture and roadside friction.

4. Safe speed for curves or hazardous locations within the zone.

5. Parking practices and pedestrian activity.

6. Reported accident experience for a recent 12-month period.

Key Elements

1. Location: On a small scale map (city plat or strip map) of the street to be surveyed, select enough speed check sites to assure a good representation of differing conditions throughout the study section. Normally, in urban and suburban areas, measurements are made at about 1,000 foot intervals, or at points where traffic and roadway characteristics change.

Care is taken to select locations sufficiently removed from any stop signs, traffic signals, or other traffic flow interruptions that significantly affect operating speeds. Mid-block locations generally represent typical flow conditions for accurate sampling.

2. Equipment: Field survey equipment consists simply of speed survey sheets and a speed measuring device, usually a radar unit in an unmarked car. Other tools include a stop watch, a ball-bank indicator for establishing advisory speeds on horizontal curves, a measuring wheel for determining sight distances, a camera, and a manual counter for recording pedestrian movements and density of roadside development.

3. Personnel: While one person can normally accomplish the field survey task, it is desirable, under busy urban conditions, to assign both an observer and a recorder to measure prevailing speeds accurately and to inventory roadway and roadside conditions.

4. Time: Speed limits are established, based on normal road conditions, to advise the motorist of safe speeds during free-flow operations. Prevailing speeds for zoning purposes are therefore measured during off-peak periods when traffic conditions are closest to free or uninterrupted flow. On most street networks, these conditions exist throughout most of the daytime hours except for the morning and afternoon commuter hours. It is sometimes desirable for comparative purposes to measure peak-hour speeds. If significant congestion occurs, however, the characteristics of peak traffic-flow are not representative of normal conditions necessary for realistic speed zoning.

5. Positioning the Speed Measuring Device: The observer attempts to locate the speed measurement device as inconspicuously as possible so as not to affect the normal flow of traffic. The speed gun is positioned at an angle of not greater than $15^{\circ}$ to the centerline of the roadway and about three feet above the surfacing of the roadway. In this position the speed gun will measure speeds in either direction or in adjacent lanes. Speeds and direction are recorded by appropriate tallies on the field survey sheet.

6. Size of Sample: Sample sizes are frequently related to traffic volumes within the study section. This type of study is satisfied by 100 properly selected observations, assuring accuracy within the normal capability of the measuring device. On multi-lane streets, either divided or undivided, separate samples should be recorded for each direction of travel.

7. Observing and Measuring Prevailing Speeds: The data collection phase of the speed survey is extremely important and requires considerable care due to the many variables involved and the sources of possible bias in sampling. For this reason it is necessary to assign a trained observer, capable of properly selecting vehicles on a truly random basis. Some common errors that tend to introduce bias, and the procedures for eliminating these errors are:

a. Selecting the first vehicle in a platoon of traffic. When traffic is constantly platooned, vehicles are selected from varying positions in the platoons. If platoons are densely packed, it may mean that congestion has been reached and that traffic is too heavy to permit a good survey.

b. Selecting too large a portion of trucks. Obtain about the same proportion of trucks on the sample as exist in the traffic stream.

c. Selecting too large a proportion of higher speed vehicles. Untrained observers often ignore measuring normal speed vehicles to "catch" a high speed vehicle to find the fastest one. Results will be biased toward the upper speed ranges.

8. Inventory of Road Conditions: The speed survey form provides space for information about existing speed zones, prevailing speeds, location of residents, roadway alignment, traffic volumes, and other general roadside physical characteristics. Visibility restrictions are recorded and deficiencies corrected to assure compatibility with the prevailing speeds. All of this information is obtained in the field.

9. Inventory of Accident Records: In speed surveys where numerous accidents have been reported, accidents for the area under study are researched. A detailed accident analysis is made, including a collision diagram for the route or intersections, as necessary. Adequate consideration may then be given to other corrective measures, the degree of enforcement emphasis needed, and the general applicability of any posted speed limit at all.

10. Analyzing Speed Survey Field Data: Two characteristics developed from the prevailing speed data are of primary importance in the selection of a reasonable limit:

a. Critical (85th percentile) Speed - This is the speed at or below which 85% of the traffic is moving. The critical speed can be determined directly from the field sheet by counting from the top speed the number of vehicles equaling 15% of the total number of vehicles observed. If

for example 100 vehicles were observed, 15% (or 15 vehicles) were traveling at 40 m.p.h. or more, then the 85th percentile would be 40 m.p.h.

The 85th percentile speed is usually within two miles per hour of the upper limit of the pace. This can be compared on the cumulative speed distribution curve, which presents a measure of the validity of the field data or the presence of an abnormal bias.

b. Pace - The pace is the 10 m.p.h. range of speeds containing the largest number of observations. This can usually be determined by visual inspection of the vehicle speed data sheet. After determining the pace, it is useful to compute the percentage of vehicles in the pace, the percentage over the pace, and the percentage under the pace. A normal speed distribution will contain approximately 70% of the sample within the pace with 15% above and 15% below.

11. Selecting the proper Speed Limit: Experience has shown that the 85th percentile speed is the one characteristic of traffic speeds most nearly conforming to a safe and reasonable limit. Speed limits set higher than the critical speed will make very few additional drivers "legal" for each 5 m.p.h. increment of speed increased. Speed limits set lower than the critical speed will make a large number of reasonable drivers "illegal" for each 5 m.p.h. increment speed is reduced. This can be easily demonstrated by development of a cumulative speed curve. As the name implies, the cumulative speed or (S) curve is a representation of cumulative speeds on a percentage basis. For example, if in the example used above, the speed limit were increased 5 m.p.h. to 45 m.p.h. from the 40 m.p.h., the 85th percentile speed would "legalize" an additional 8% of the sample traffic, while a decrease of 5 m.p.h. to 35 m.p.h. would make "violators" of an additional 21% of the sampled traffic.

For practical purposes, the 5 m.p.h. increment at or immediately below the 85th percentile (or the upper limit of the pace) is the numerical value properly selected for posting a realistic and enforceable speed limit.

12. Final Consideration: As a final aid to establishing realistic speed zones, the following practical considerations are kept in mind:

a. Intermediate speed limits are applicable to through routes having positive intersection controls, good signing, striping and markings to accommodate appreciable volumes of traffic from beyond the immediate neighborhood.

b. Unusually short zones of less than 1,000 feet in length are avoided whenever possible.

c. Speed zone changes are coordinated with visible changes in roadway conditions or roadside developments.

d. Successive 5 m.p.h. speed zone changes are avoided by properly selecting longer speed zones in 10 m.p.h. increments.

e. Speed zoning is coordinated with adjacent jurisdictions to assure compatibility.

An after-study of operating speeds in a newly established speed zone is made to verify appropriateness, relative effectiveness and general acceptance by the motoring public.

# H O W   F A S T ?

## A SHORT COURSE IN SPEED ZONES AND TRAFFIC FROM THE MONTANA DEPARTMENT OF HIGHWAYS

(excerpted from brochure)

## HOW FAST?

How fast? We answer that question each time we get behind the wheel and go about our business. Our answer depends on many things - road conditions, traffic, the weather, roadside activity - and the speed we choose takes all these things into account.

This concept - speed based on conditions - is basic to the process of setting speed limits in all 50 states. It recognizes most drivers will drive at a reasonable and safe speed, but also recognizes attempting to slow down traffic by setting restrictive speed limits just doesn't work.

> "Unnecessary or unrealistic speed zones make conditions worse by restricting traffic and creating new conflicts for motorists. Changing the speed limit does not necessarily change the speed of traffic - nor does it affect safety."

Traffic engineers think of traffic speeds in terms of pace. When most vehicles are traveling at about the same pace, the change of collisions is greatly reduced.

To determine this pace, radar is used to measure the speed of vehicles traveling in both directions and engineers calculate the speed most drivers are driving. The greater the percentage of vehicles in the pace, the fewer conflicts the driver has to deal with and the safer the roadway.

In addition to radar measurements of traffic speeds, several other factors must be considered in the "traffic and engineering study" required by law before speed limits can be set or changed:

- road surface and condition;
- curves and hazards;
- roadside development, such as business and advertising signs-sometimes called roadside friction;
- parking and pedestrian activity;
- accident records.

Since motorists take most of these things into account when determining their speed, the best measurement for speed zone setting is still the speed most drivers are driving - what engineers call the eighty-fifth percentile speed. From this information, we can plan a series of speed zone signs that make sense for the area.

What about school crossings? One good solution to school crossing safety concerns is a safety patrol or crossing guard. Trained workers or volunteers use signs to slow or stop traffic for pedestrians and help teach children good habits so they recognize the best time to cross. Safety patrols can have a real impact on school or pedestrian safety - much more than an artificially set speed limit or traffic control signs.

Traffic engineers can also improve safety in school areas by working with school officials and parents to change dangerous parking habits and identify crosswalks. Often people don't realize the danger of their driving habits, but cooperation between officials, parents and traffic engineers can improve traffic and pedestrian safety.

Q. Don't speed limit signs slow traffic?

A. No. Signs are just one of many factors drivers consider when setting their speed. Before and after studies in many Montana communities, and across the country, show that simply lowering the speed limit does not slow traffic.

Q. Won't raising the speed limit cause an increase in the speed of traffic?

A. No. Time and again, studies show speed limit signs have little or no effect on the speed of traffic.

Q What if officials just lower the speed limits, despite the results of the speed study? Won't this make for a safer street or highway?

A. No. First, no significant change in speed will take place..

Then, if local officials decide to enforce the lower limit, a speed trap is created. Now, most drivers are law breakers.

Some drivers - a few at least - will slow down and attempt to drive at the artificially set speed. Now the other drivers have an additional obstacle - a slow-moving vehicle. This forces the driver to spend more time watching the vehicles ahead or behind, diverting attention from the important business of watching the road.

What's more, as soon as visible enforcement - police or patrolman - is gone, speed increases. Artificially low speed limits only reduce driver compliance and can cause a more hazardous situation.

Public safety is central to the role of the Department of Highways. Through engineering and education, we strive to make Montana's roads safe for our residents and for those who visit our state. Well-thought-out and consistent traffic control is essential to that effort, and it's the reason we seek your support for properly set speed limits and speed zones.

For more information, contact the District Traffic Engineer for your area or the Traffic Unit at the Montana Department of Highways in Helena.

MONTANA DEPARTMENT OF HIGHWAYS
Glendive, Montana 59330-0890

MEMORANDUM

TO: Greg Jackson, P.E., Manager
Traffic Unit

FROM: Donald F. Williams
District Traffic Engineer

RE: Nashua Speed Zone
Montana 117

DATE: January 14, 1987

Please provide me with the existing approved speed zone signing south of Nashua so maintenance can erect the proper signing.

DFW:jlw:3j

cc: District File
Wolf Point

U

MONTANA DEPARTMENT OF HIGHWAYS
Helena, Montana 59620

MEMORANDUM

TO: Jay B. Randall, P.E.
District Engineer - Glendive

FROM: Gregory A. Jackson, P.E., Manager
Traffic Unit

RE: Nashua Speed Zone Status (MT 117)

DATE: February 20, 1987

In regards to Mr. Williams' memo concerning the Nashua speed zone (MT 117), we have researched all our files and found nothing.

We do not have an approved speed zone. Before any legal signing can be installed, an engineering study must be done. Please contact the proper local officials about the situation and ask them to send a letter of request.

We will await their written reply.

GAJ:GC:cm:5/k

MONTANA DEPARTMENT OF HIGHWAYS
Glendive, Montana 59330-0890

MEMORANDUM

TO: Greg Jackson, P.E., Manager
Traffic Unit

FROM: Donald F. Williams DFW
District Traffic Engineer

RE: Nashua Speed Zone
Montana 117 (FAP 17, [illegible] 11-[illegible] - MP 13+0.030

DATE: March 12, 1987

Contact has been made with Mrs. Compton, City Clerk in Nashua, on the possibility of making the speed zone presentation to the council on Tuesday evening the 7th of April. This will allow the Department to revise the abrupt 55 to 25 speed limit transition south of town on Montana Highway 117.

DFW:jlw:4o

cc: District File
Jerry Wade

March 17, 1987

Gregory A. Jackson, P.E.
Manager, Traffic Unit
Montana Department of Highways
2701 Prospect Avenue
Helena, MT 59620

SPEED ZONE STUDY

Based on the procedures outlined at the recent meeting, the Nashua Town Council requests the Montana Department of Highways complete a speed zone study and investigation on MT117. It is our understanding that Department personnel will present the findings of the speed zone study and investigation and the Department's recommendations to the Nashua Town Council.

It is also our understanding that the Nashua Town Council will have 60 days after receiving the recommendations and findings to transmit its comments to you. The comments of the Nashua Town Council, as well as the Montana Department of Highways' recommendations, will be presented to the Montana Highway Commission for its action on this speed zone request.

The changes, as approved by the Montana Highway Commission, will be implemented as soon as possible after receiving notification of approval.

GC:mb:2/p

MONTANA DEPARTMENT OF HIGHWAYS
Helena, Montana 59620

MEMORANDUM:

TO: Robert E. Champion, P.E., Administrator
Program Development Division

FROM: Gregory A. Jackson, P.E.
Manager - Traffic Unit

RE: Accident Request FAP 117
MP 11 - MP 13.03 - Nashua

DATE: March 17, 1987

Please provide us with whatever accident data you have on FAP 17 from Milepost 11 to 13.03. We need this material by April 6th.

GAJ:GC:mb:2/oo

DEPARTMENT OF HIGHWAYS

TED SCHWINDEN GOVERNOR

2701 PROSPECT

STATE OF MONTANA

HELENA, MONTANA 59620

March 18, 1987

Board of County Commissioners
Valley County
P.O. Box 311
Glasgow, MT 59230

SPEED ZONE MEETING

We have been requested to conduct a speed zone investigation on MT 117 in Nashua. The request originated with the City Clerk; and because of the request, a meeting between the Department of Highways and City officials has been scheduled for April 7, 1987. The meeting will describe our method of establishing a realistic speed zone.

The meeting usually lasts one and one-half hours, depending on the number of questions. Since some of the speed zone stations will be within county jurisdiction, we feel it would be beneficial for the majority of the Valley County Commissioners to attend this meeting.

If you would like to attend this meeting, please contact Greg Jackson at 444-6217.

Gordon L. Larson

For STEPHEN C. KOLOGI, P.E., CHIEF
PRECONSTRUCTION BUREAU

SCK:GC:cm:3/r

AN EQUAL OPPORTUNITY EMPLOYER

March 18, 1987

Gregory A. Jackson, P.E.
Manager, Traffic Unit
Montana Department of Highways
2701 Prospect Avenue
Helena, MT 59620

SPEED ZONE STUDY

Based on the procedures outlined at the recent meeting, the Valley County Commission requests the Montana Department of Highways complete a speed zone study and investigation on MT 117. It is our understanding that Department personnel will present the findings of the speed zone study and investigation and the Department's recommendations to the Valley County Commission.

It is also our understanding that the Valley County Commission will have 60 days after receiving the recommendations and findings to transmit its comments to you. The comments of the Valley County Commission, as well as the Montana Department of Highways' recommendations, will be presented to the Montana Highway Commission for its action on this speed zone request.

The changes, as approved by the Montana Highway Commission, will be implemented as soon as possible after receiving notification of approval.

GC:cm:3/y

MONTANA DEPARTMENT OF HIGHWAYS
HELENA, MONTANA 59620

MEMORANDUM

TO: Greg Jackson, P.E., Manager
Traffic Unit

ATTN: George Cruickshank

FROM: W. H. Butzlaff, Supervisor
Project Planning Section

RE: Accident Data
P-17, M.P. 11.0 - 13.03, Nashua

DATE: March 24, 1987

Attached is the computer accident analysis for the following project as requested by your memorandum of March 17, 1987.

FAP-17 milepost 11.0 to 13.03.

The accident information is for the time period of January 1, 1979 through December 31, 1986.

The statewide average accident rate for primary routes is 2.13 with a high average of 3.72. The statewide average severity rate for primary routes is 1.51 with a high average of 1.76.

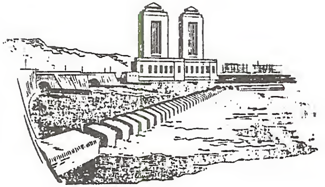
The following portions of the accident analysis printout have been reviewed by this section. Analysis Codes I and II, Junction Related, Roadway Related, First Harmful Event, First Object Hit, Weather Condition, Road Condition, Light Condition and Body Type.

As you will note on the computer printout, six of the seven accidents that occurred at this location were overturning type accidents. This is considerably higher than the statewide primary average of 24% for this type of accident. None of the remaining accident details that we have reviewed seem to vary significantly from the average occurrence.

If you need additional information, please contact me at 6113.

WHB/GK/jm/2qq

Attachments



**OFFICE OF THE MAYOR**

TOWN OF NASHUA
Nashua, Montana 59248

| Date Recd. Precon: | | Attach | Initial |
|---|---|---|---|
| MAIL ROUTE | | | |
| 29 | | | |
| 30 Eng. Specialties | | | |
| 31 Contract Plans | | | |
| 32 Loc. Road Design | | | |
| 33 Environment | | | |
| 34 Hydraulic | | | |
| 35 Surfacing Design | | | |
| 36 Traffic | ✓ | | |
| 37 Pub. Hearing | | | |
| 38 Photogrammetry | | | |
| 39 Consultant Design | | | |

April 16, 1987

Gregory A. Jackson, P.E.
Manager, Traffic Unit
Montana Department of Highways
2701 Prospect Avenue
Helena, MT 59620

Re: SPEED ZONE STUDY

Dear Mr. Jackson:

On April 7, 1987, the Town of Nashua held it's regular council meeting, at which time it was decided that a request be made of the Montana Department of Highways to complete a speed zone study and investigation on Montana Hwy 117, which passes through Nashua. The Town of Nashua is requesting two additional speed zone signs to be posted along Montana Hwy 117 before you enter the City limits.

There have been several complaints to the Police Dept. concerning this matter. It is our understanding that Highway Department Personnel will present it's findings of the study, and the Department's recommendations, to the Nashua Town Council. It is also the understanding of the Council that they will have 60 days to respond to the findings of the survey, and transmit their comments to you. Both the comments of the Nashua Town Council, as well as the findings from the Department of Highways will be presented to the Montana Highway Commission for it's action on this speed zone request.

The addition of the two requested speed zone signs, as approved by the Montana Highway Commission, will be implemented as soon as possible upon receiving notification of approval.

Sincerely,

Barbara Boner

Mayor Barbara Boner
Nashua, MT

BB/gd

MONTANA DEPARTMENT OF HIGHWAYS
Helena, Montana 59620

MEMORANDUM

TO: Don M. Harriott, P.E., Administrator
Engineering Division

FROM: Greg A. Jackson, P.E., Manager
Traffic Unit

RE: Nashua Speed Zone - MT117

DATE: April 23, 1987

The meeting in Nashua was very uneventful. Don Williams and I attended the city council meeting on April 7. Their purpose is to establish a step-down speed zone for traffic entering town on MT 117.

GAJ:ml:4/pp

cc: Jay Randall
Dennis Unsworth

Location [illegible]
Legal Speed Limit [illegible] MPH

Date 9- [illegible] -97
Time Period [illegible]
Weather [illegible]

Calculate by ______

| Speed Group MPH | Total Vehicles | Percent Of Total | Accum. Percent |
|---|---|---|---|
| 26 | (21) | | |
| 28 | | | |
| 30 | | | |
| 32 | | | |
| 34 | 1 | | |
| 36 | 2 | | |
| 38 | 3 | | |
| 40 | 5 | | |
| 42 | 6 | | |
| 44 | 4 | | |
| 46 | 4 | | |
| 48 | 5 | | |
| 50 | 8 | | |
| 52 | 7 | | |
| 54 | 4 | | |
| 56 | 4 | | |
| 58 | 3 | | |
| 60 | 4 | | |
| 62 | 3 | | |
| 64 | 3 | | |
| 66 | 0 | | |
| 68 | 0 | | |
| 70 | 0 | | |
| 72 | 0 | | |
| 74 | 1 | | |
| | 69 | | |

Direction [illegible]

Recorded by ______

| Speed Group MPH | Total Vehicles | Percent Of Total | Accum. Percent |
|---|---|---|---|
| 26 | | | |
| 28 | | | |
| 30 | | | |
| 32 | | | |
| 34 | | | |
| 36 | | | |
| 38 | | | |
| 40 | | | |
| 42 | | | |
| 44 | | | |
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| 70 | | | |
| 72 | | | |
| 74 | | | |

Direction ______

Location [illegible] Date 5- 2 77

Time Period [illegible]

Legal Speed Limit 50 MPH [illegible] 55 [illegible]) Weather [illegible]

| Speed Group MPH | 10 20 30 40 | Total Vehicles | Percent Of Total | Accum. Percent |
|---|---|---|---|---|
| 26 | | 1 | | |
| 28 | | 0 | 16 | |
| 30 | | 5 | | |
| 32 | | 5 | | |
| 34 | | 7 | | |
| 36 | | 11 | | |
| 38 | | 12 | | |
| 40 | | 9 | | |
| 42 | | 8 | | |
| 44 | | 6 | | |
| 46 | | 4 | | |
| 48 | | 4 | | |
| 50 | | 5 | | |
| 52 | | 4 | | |
| 54 | | 2 | | |
| 56 | | 1 | | |
| 58 | | | | |
| 60 | | | | |
| 62 | | 83 | | |
| 64 | | | | |
| 66 | | | | |
| 68 | | | | |
| 70 | | | | |
| 72 | | | | |
| 74 | | | | |

Direction ________

Calculated by ________

| Speed Group MPH | 10 20 30 40 | Total Vehicles | Percent Of Total | Accum. Percent |
|---|---|---|---|---|
| 26 | | | | |
| 28 | | | | |
| 30 | | | | |
| 32 | | | | |
| 34 | | | | |
| 36 | | | | |
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| 70 | | | | |
| 72 | | | | |
| 74 | | | | |

Direction ________

Recorded by ________

Location ______________ Date ______
Legal Speed Limit _____ MPH Time Period ______
Weather ______

| Speed Group MPH | 10 20 30 40 | Total Vehicles | Percent Of Total | Accum. Percent |
|---|---|---|---|---|
| 16 | | 3 | (13) | |
| 18 | | 5 | | |
| 20 | | 6 | | |
| 22 | | 13 | | |
| 24 | | 17 | | |
| 26 | | 19 | | |
| 28 | | 14 | | |
| 30 | | 9 | | |
| 32 | | 7 | | |
| 34 | | 4 | | |
| 36 | | 3 | | |
| 38 | | 1 | | |
| 40 | | 1 | | |
| 42 | | | | |
| 44 | | 103 | | |
| 46 | | | | |
| 48 | | | | |
| 50 | | | | |
| 52 | | | | |
| 54 | | | | |
| 56 | | | | |
| 58 | | | | |
| 60 | | | | |
| 62 | | | | |
| 64 | | | | |

Direction ______

| Speed Group MPH | 10 20 30 40 | Total Vehicles | Percent Of Total | Accum. Percent |
|---|---|---|---|---|
| 16 | | | | |
| 18 | | | | |
| 20 | | | | |
| 22 | | | | |
| 24 | | | | |
| 26 | | | | |
| 28 | | | | |
| 30 | | | | |
| 32 | | | | |
| 34 | | | | |
| 36 | | | | |
| 38 | | | | |
| 40 | | | | |
| 42 | | | | |
| 44 | | | | |
| 46 | | | | |
| 48 | | | | |
| 50 | | | | |
| 52 | | | | |
| 54 | | | | |
| 56 | | | | |
| 58 | | | | |
| 60 | | | | |
| 62 | | | | |
| 64 | | | | |

Calculated by ______
Recorded by ______

Location ______________  Date ______ ______________

Legal Speed Limit _____ MPH  Time Period ______________

Weather ______________

| Speed Group MPH | 10 | 20 | 30 | 40 | Total Vehicles | Percent Of Total | Accum. Percent |
|---|---|---|---|---|---|---|---|
| 16 | | | | | 2 | | |
| 18 | | | | | 5 | 12 | |
| 20 | | | | | 7 | | |
| 22 | | | | | 14 | | |
| 24 | | | | | 23 | | |
| 26 | | | | | 23 | | |
| 28 | | | | | 17 | | |
| 30 | | | | | 7 | | |
| 32 | | | | | 3 | | |
| 34 | | | | | 2 | | |
| 36 | | | | | 1 | | |
| 38 | | | | | 1 | | |
| 40 | | | | | | | |
| 42 | | | | | 107 | | |
| 44 | | | | | | | |
| 46 | | | | | | | |
| 48 | | | | | | | |
| 50 | | | | | | | |
| 52 | | | | | | | |
| 54 | | | | | | | |
| 56 | | | | | | | |
| 58 | | | | | | | |
| 60 | | | | | | | |
| 62 | | | | | | | |
| 64 | | | | | | | |

Direction ______

| Speed Group MPH | 10 | 20 | 30 | 40 | Total Vehicles | Percent Of Total | Accum. Percent |
|---|---|---|---|---|---|---|---|
| 16 | | | | | | | |
| 18 | | | | | | | |
| 20 | | | | | | | |
| 22 | | | | | | | |
| 24 | | | | | | | |
| 26 | | | | | | | |
| 28 | | | | | | | |
| 30 | | | | | | | |
| 32 | | | | | | | |
| 34 | | | | | | | |
| 36 | | | | | | | |
| 38 | | | | | | | |
| 40 | | | | | | | |
| 42 | | | | | | | |
| 44 | | | | | | | |
| 46 | | | | | | | |
| 48 | | | | | | | |
| 50 | | | | | | | |
| 52 | | | | | | | |
| 54 | | | | | | | |
| 56 | | | | | | | |
| 58 | | | | | | | |
| 60 | | | | | | | |
| 62 | | | | | | | |
| 64 | | | | | | | |

Calculated by ______

Recorded by ______

Location ____________ Date ____________

Legal Speed Limit _____ MPH Time Period ____________

Weather ____________

Calculated by ____________

| Speed Group MPH | 10 | 20 | 30 | 40 | Total Vehicles | Percent Of Total | Accum Percent |
|---|---|---|---|---|---|---|---|
| 16 | | | | | 2 | 10 | |
| 18 | | | | | 5 | | |
| 20 | | | | | 9 | | |
| 22 | | | | | 19 | | |
| 24 | | | | | 24 | | |
| 26 | | | | | 20 | | |
| 28 | | | | | 12 | | |
| 30 | | | | | 8 | | |
| 32 | | | | | 3 | | |
| 34 | | | | | 2 | | |
| 36 | | | | | 104 | | |
| 38 | | | | | | | |
| 40 | | | | | | | |
| 42 | | | | | | | |
| 44 | | | | | | | |
| 46 | | | | | | | |
| 48 | | | | | | | |
| 50 | | | | | | | |
| 52 | | | | | | | |
| 54 | | | | | | | |
| 56 | | | | | | | |
| 58 | | | | | | | |
| 60 | | | | | | | |
| 62 | | | | | | | |
| 64 | | | | | | | |

Direction ____________

Recorded by ____________

| Speed Group MPH | 10 | 20 | 30 | 40 | Total Vehicles | Percent Of Total | Accum. Percent |
|---|---|---|---|---|---|---|---|
| 16 | | | | | | | |
| 18 | | | | | | | |
| 20 | | | | | | | |
| 22 | | | | | | | |
| 24 | | | | | | | |
| 26 | | | | | | | |
| 28 | | | | | | | |
| 30 | | | | | | | |
| 32 | | | | | | | |
| 34 | | | | | | | |
| 36 | | | | | | | |
| 38 | | | | | | | |
| 40 | | | | | | | |
| 42 | | | | | | | |
| 44 | | | | | | | |
| 46 | | | | | | | |
| 48 | | | | | | | |
| 50 | | | | | | | |
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| 54 | | | | | | | |
| 56 | | | | | | | |
| 58 | | | | | | | |
| 60 | | | | | | | |
| 62 | | | | | | | |
| 64 | | | | | | | |

[illegible] number STA [illegible] in NASHUA MT 117
[illegible] AND [illegible]

the 85th percentile speed is 27.57 mph
the total number of vehicles in the sample is 104
the average speed of this sample is 24.56 mph
the standard deviation of this sample is 3.75 mph
the standard error of the mean is 0.367 mph
the upper limit of the pace is 30 mph
the lower limit of the pace is 20 mph
the number of vehicles in the pace is 84
the percent of vehicles in the pace is 80.77
the [illegible]7th percentile speed = 18.06 mph
the 50th percentile speed = 23.42 mph
the [illegible]0th percentile speed = 28.65 mph
the 93rd percentile speed = 29.43 mph

station number STA 2 in NASHUA MT 117
[illegible] ST AND ALLEN ST

the 85th percentile speed is 25.99 mph
the total number of vehicles in the sample is 107
the average speed of this sample is 23.27 mph

the standard deviation of this sample is 4.03 mph
the standard error of the mean is 0.390 mph
the upper limit of the pace is 30 mph
the lower limit of the pace is 20 mph
the number of vehicles in the pace is 86
the percent of vehicles in the pace is 80.37
the [illegible]7th percentile speed = 16.14 mph
the 50th percentile speed = 22.22 mph
the [illegible]0th percentile speed = 27.18 mph
the 93rd percentile speed = 27.89 mph

station number 3 in NASHUA MT 117
RIVER ST

the standard deviation of this sample is 4.91 mph
the standard error of the mean is 0.484 mph
the upper limit of the pace is 32 mph
the lower limit of the pace is 22 mph
the number of vehicles in the pace is 73
the percent of vehicles in the pace is 70.87
the 15th percentile speed = 17.46 mph
the 50th percentile speed = 24.68 mph
the 90th percentile speed = 31.63 mph
the 93rd percentile speed = 32.90 mph

station number 4 in NASHUA MT 117
AT START OF CURVE

the 85th percentile speed is 47.78 mph
the total number of vehicles in the sample is 83

the average speed of this sample is 40.00 mph
the standard deviation of this sample is 6.91 mph
the standard error of the mean is 0.758 mph
the upper limit of the pace is 42 mph
the lower limit of the pace is 32 mph
the number of vehicles in the pace is 45
the percent of vehicles in the pace is 54.22
the 15th percentile speed = 29.92 mph
the 50th percentile speed = 37.75 mph
the 90th percentile speed = 49.48 mph
the 93rd percentile speed = 50.60 mph

station number 5 in NASHUA MT 117
AT MP 12

the 85th percentile speed is 58.83 mph
the total number of vehicles in the sample is 69
the average speed of this sample is 50.14 mph
the standard deviation of this sample is 8.77 mph
the standard error of the mean is 1.055 mph
the upper limit of the pace is 54 mph
the lower limit of the pace is 44 mph
the number of vehicles in the pace is 29
the percent of vehicles in the pace is 42.03
the 15th percentile speed = 37.22 mph
the 50th percentile speed = 48.88 mph
the 90th percentile speed = 60.73 mph
the 93rd percentile speed = 62.11 mph

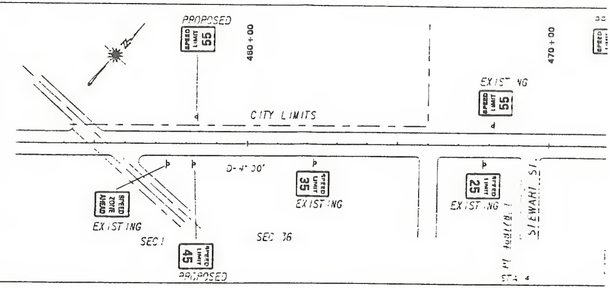
STATE OF MONTANA
DEPARTMENT OF HIGHWAYS
TRAFFIC UNIT

SPEED ZONE SURVEY

Location NASHUA
County VALLEY
Roadway MT 117
Sta from 398+00 to 508+40.2
Scale 1" = 200'
Date 2-18-88

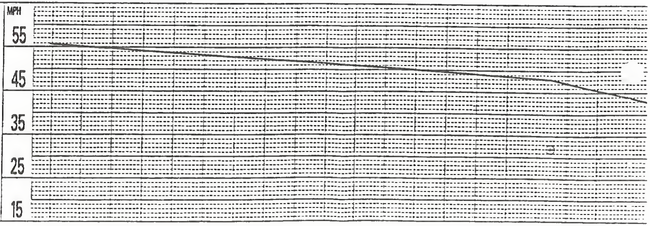
LEGEND

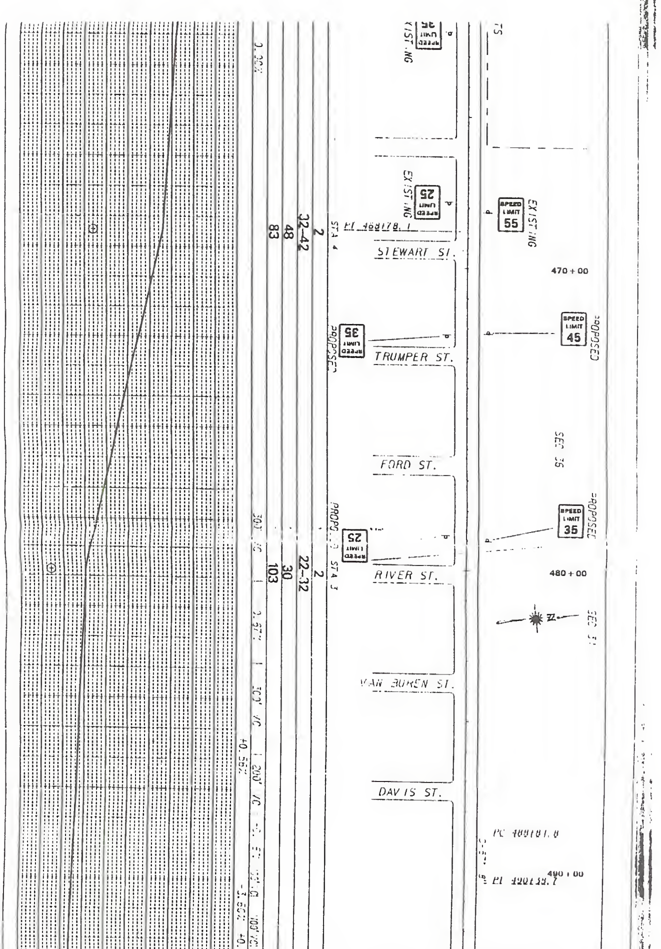
Road Signs
85th Percentile
Lower Limit of Pace

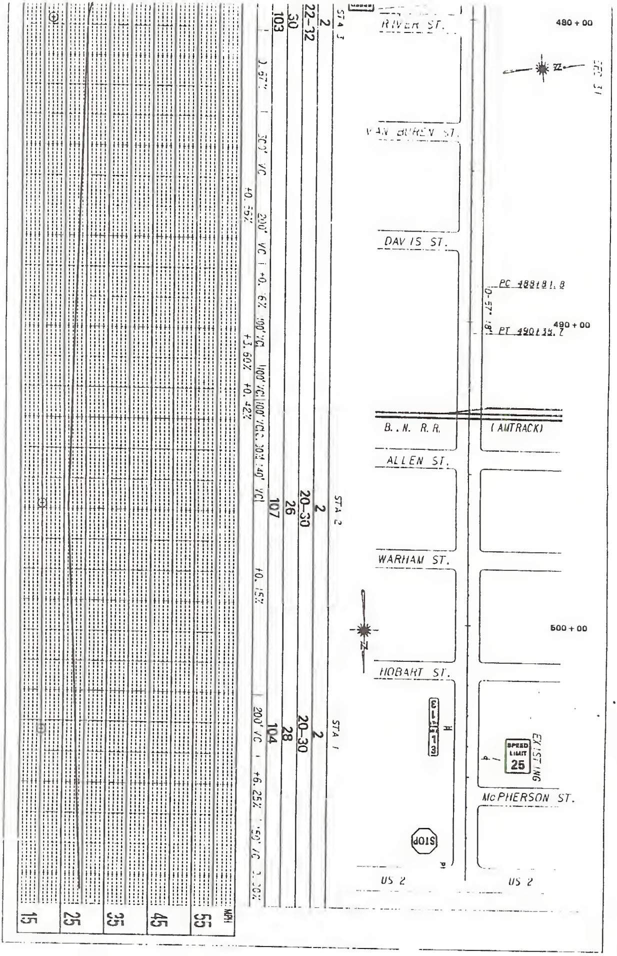



| | |
|---|---|
| Number of Striped Lanes | 2 |
| Observed Speed - Pace | 32-42 |
| 85th Percentile | 48 |
| Number of Vehicles | 83 |
| Vertical Curves | 0.00% |

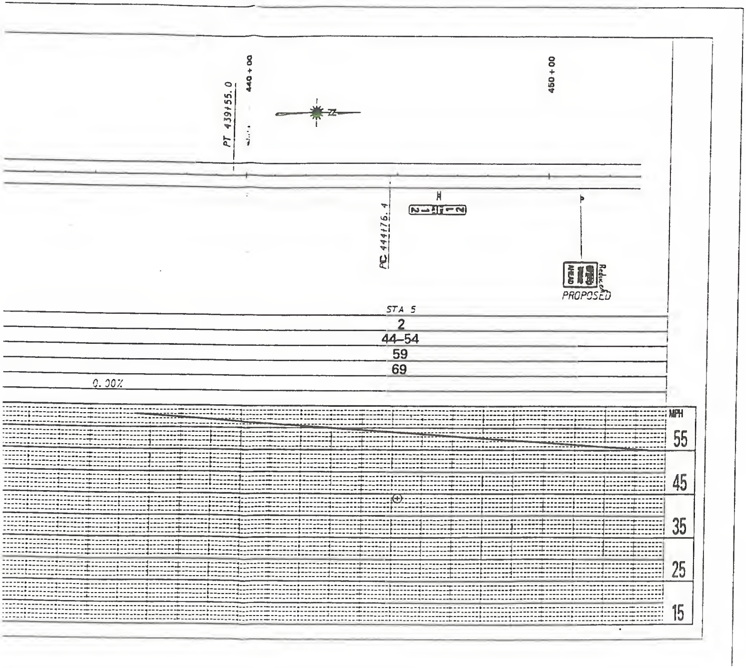
Remarks:




EXISTING
STEWART ST.
TRUMPER ST.
FORD ST.
RIVER ST.
VAN BUREN ST.
DAVIS ST.
B. N.
(AMTRACK)
470 + 00
480 + 00
490 + 00
PROPOSED
SEC 36
SPEED LIMIT 55
SPEED LIMIT 45
SPEED LIMIT 35
SPEED LIMIT 25
2
32-42
48
83
22-32
30
103
+0.56%
-3.60%
+0.42%



RIVER ST.
480 + 00
VAN BUREN ST.
DAVIS ST.
PC 488+81.8
PT 490+35.7
490 + 00
B.N. R.R.
(AMTRACK)
ALLEN ST.
WARHAM ST.
500 + 00
HOBART ST.
EXISTING
SPEED LIMIT 25
McPHERSON ST.
STOP
US 2
US 2
STA 3
2
22-32
30
103
STA 2
2
20-30
26
107
STA 1
2
20-30
28
104
300' VC
+0.15%
200' VC
+0.6%
100' VC
+3.60%
+0.42%
200' VC
+6.25%
MPH
15
25
35
45
55



PT 439+55.0
440+00
450+00
PC 444+76.4
H
PROPOSED
Reduced
STA 5
2
44-54
59
69
0.00%
MPH
55
45
35
25
15

*U*

MONTANA DEPARTMENT OF HIGHWAYS
Helena, Montana 59620

MEMORANDUM

TO: Jay B. Randall, P.E.
District Engineer - Glendive

FROM: Gregory A. Jackson, P.E., Manager
Traffic Unit

RE: Speed Zone Recommendation
MT 117 - Nashua

DATE: February 22, 1988

Originally the MT 117 speed zone file was opened because the district wanted to replace the proper speed zone signs. Upon reviewing the file, it was determined that there was not a Highway Commission approved speed zone. The Glendive District then contacted the town clerk in Nashua and a meeting was scheduled to discuss our speed zoning methodology. After the meeting a letter from the Nashua city officials was forwarded to us requesting a study.

The roadside culture is comprised of small businesses and family dwelling units. There are no established school or pedestrian crosswalks. The roadway surface is in fair condition; however, there is no curbing in Nashua therefore, there are no defined entrances or exits to the businesses. Even with the uncontrolled access, we saw no major traffic problems. Angle and parallel parking is allowed.

Five speed monitoring stations were taken within the study area. A minimum of 100 vehicles were sampled at the three stations within the developed area of Nashua. Eighty-fifth percentile speeds ranged from 26 mph to 59 mph. Presently the existing step-down does not conform to speed zoning standard plus it is not an approved speed zone.

Our recommendations are as follows:

25 mph beginning at the intersection of U.S. 2 and MT 117 on Project S 332(6) and proceed south and then west to Station 479+00 approximately 100 feet west of River Street.

35 mph beginning at Station 479+00 and proceeds west to Station 472+00 approximately 100 feet west of Trumper Street.

45 mph beginning at Station 472+00 and proceeds west and then south to Station 458+00 approximately 1100 feet southwest of Stewart Street.

Presentation of this speed zone will reflect the shortening of the existing 25 mph by approximately 1100 feet and a shortening of the existing 35 mph by approximately 900 feet. The important factor to convey to those in attendance is the existing speed zone is not legal. Acceptance of our proposals will create a realistic speed zone which conforms to the normal driving tempo and it will be enforceable.

To aid you in your presentation we have included a copy of the straightline and copies of the computer data. Written correspondence and/or comments from the local officials are due within 60 days of presentation.

GAJ:GC:cm:1/n

Attachments

MONTANA DEPARTMENT OF HIGHWAYS
Glendive, Montana 59330-0890

MEMORANDUM

TO: Greg Jackson, P.E., Manager
Traffic Unit

FROM: Donald F. Williams
District Traffic Engineer

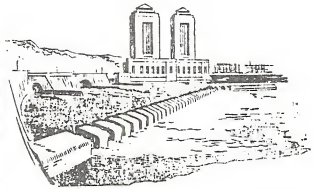
RE: Nashua Speed Zone
Montana 117

DATE: April 7, 1988

This will acknowledge my presentation to the City Council on Tuesday night, April 5, 1988. The presentation was not what they wanted to hear but their positions seemed to soften. They will reply later. I pointed out the 60 day replay period.

DFW:jlw:4d

cc: District File



**OFFICE OF THE MAYOR**

TOWN OF NASHUA
Nashua, Montana 59248

April 26, 1988

Mr. Jay B. Randall, P.E.
District Engineer
Glendive, Montana

Dear Mr. Randall:

This letter is in response to your completed survey which was done on Highway #117 leading west out of Nashua, concerning the speed zone.

In our original request the Nashua Police Dept. asked for two additional 25 MPH speed zone signs to be posted on Highway #117 between River St. and Ford St., one sign to be facing east and one to be facing west. After your survey was completed, Mr. Don Williams presented your findings to us at the April 5th city council meeting. Your recommendation to us was that we increase the now existing 25 MPH zone from Stewart St. to River St. to 35 MPH and then reduce to 25 MPH.

CONFIRMATION 25

After discussing this matter with the Police Dept., it is our opinion that to increase the speed to 35 MPH in the area fore mentioned would only increase the problem of speeding through our business section of town, which is already a problem.

We would like to make this recommendation; leave the speed zone signs as they are, with the exeption of the first two signs as you enter Nashua from the south. We would like to replace the "Speed Zone Ahead" sign with a 45 MPH sign, and move the "Speed Zone Ahead" sign farther south. If the signs were properly spaced, we feel this would be of more help than to increase the speed in town.

In addition, the Police Dept. would still like to have two additional 25 MPH signs posted in the area mentioned earlier.

We would like to thank you for your many hours spent on a survey concerning this matter, to help us find an answer to our problem, and we hope that our recommendation will also be agreeable to you.

Sincerely,

Barbara Boner, Mayor

NORTHEAST GATEWAY TO FORT PECK DAM RECREATION AREA

MONTANA DEPARTMENT OF HIGHWAYS
Glendive, Montana 59330-0890

MEMORANDUM

TO: Greg Jackson, P.E., Manager
Traffic Unit

FROM: Donald F. Williams
District Traffic Engineer

RE: Nashua Speed Zone
Montana 117

DATE: May 2, 1988

We have received Nashua's reply to the speed study and it is attached. They are desirous to maintain the existing and move the step down speeds farther out which will be restrictive.

DFW:jlw:lf

cc: Steve Herzog
District File

DEPARTMENT OF HIGHWAYS

TED SCHWINDEN GOVERNOR

2701 PROSPECT

STATE OF MONTANA

HELENA MONTANA 59620

May 4, 1988

Honorable Barbara Boner
Mayor of Nashua
Nashua, MT 59248

NASHUA SPEED ZONE

A copy of your letter to Jay Randall was forwarded to my office. It will be submitted to the Highway Commission along with all of our data and recommendation.

The reason for this letter is to reinforce the information I presented at the city council meeting. No matter what we do with the signs, the speed will remain the same in the business section of town. Safety will not be effected unless we lower the speed below what it should be. If this is done, more accidents can be caused.

I am sending you a copy of a pamphlet that was developed by Texas on speed zoning. Through many years of study in Montana, we can say the same principles apply here.

If you have any questions, please write to me or call me at 444-6217.

Gregory A. Jackson

GREGORY A. JACKSON, P.E.
MANAGER - TRAFFIC UNIT

GAJ:mb:2/A

cc: Bruce Russell

MONTANA DEPARTMENT OF HIGHWAYS
Helena, Montana 59620

MEMORANDUM:

TO: Don M. Harriott, P.E.
Administrator - Engineering Division

FROM: Stephen C. Kologi, P.E.
Chief - Preconstruction Bureau

RE: Speed Zone Recommendations
MT 117 - Nashua
For Commission Approval

DATE: July 22, 1988

The existing speed zone configuration on MT 117 through Nashua was first brought to our attention by the Glendive District. They were in the process of replacing speed zone signs and wanted to know the correct locations. We checked our files and found that we did not have a Highway Commission approved speed zone. The District then contacted the Nashua town officials and set a date for our informative speed zone meeting.

The meeting was held and it went very well. The local governmental body wanted to establish a proper step-down speed zone and seemed very receptive to the methods we would use. During the meeting, those in attendance are told changes will occur based on the results of the study and those changes may not necessarily coincide with popular opinion. Mayor Boner sent us a letter requesting that we proceed with the investigation. The letter in effect states that if a study is done the local officials will agree, for the most part, with the results of the investigations.

Our recommendations have been reviewed by the town officials. They do not agree and have made recommendations of their own. The Nashua officials want us to leave the speed zone signs as they are and add a couple of 45 mph signs beyond the existing 35 mph signs.

Again, as with many other speed studies, they are concerned because we have proposed increases. True, we have written down the speeds which indicate increases, but actually the motorists who drive MT 117 have established the speeds. Our radar samples reflect the speeds at which motorists feel comfortable driving. The problem is the existing speed zone does not conform to Department policy because it is a 55 mph - 25 mph step down; and it is not an approved speed zone. There is a 35 mph on the west end entering Nashua, but it precedes the 25 mph - 55 mph break. The existing 25 mph speed zone is as much as 19 mph restrictive. Our recommended step down will benefit the motorist and law enforcement alike.

Montana 117 through Nashua is two lane, in fair condition and with good sight distance. There are no established school or pedestrian crosswalks. Our study area was approximately 6,800 feet in length. Speeds were monitored at five locations. Eighty-fifth percentile speeds range from 28 mph to 59 mph.

We propose the following speed zone configuration:

25 mph begins at the intersection of U.S. 2 and MT 117 on project S 332(6) and proceeds south and then west to Station 479+00, approximately 100 feet west of River Street, a distance of 2,900 feet.

35 mph begins at Station 479+00 and proceeds west to Station 472+00, approximately 100 feet west of Trumper Street, a distance of 700 feet.

45 mph begins at Station 472+00 and proceeds west and then south to Station 458+00, approximately 1,100 feet south of Stewart Street, a distance of 1,400 feet.

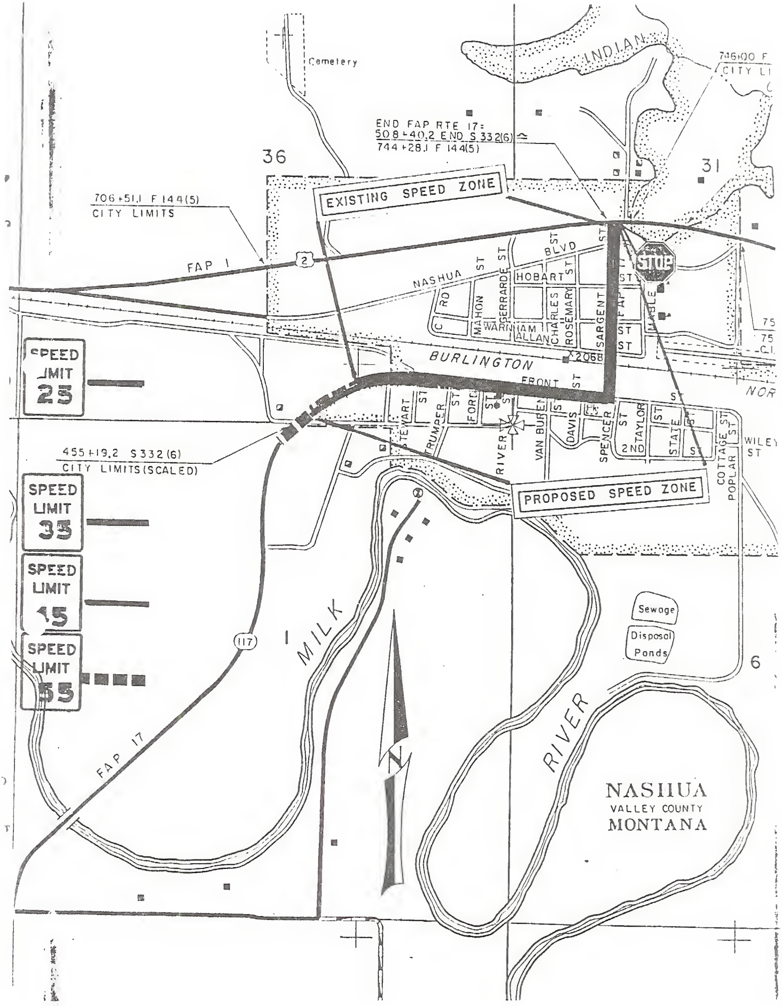
The total distance is 5,000 feet or .9 of a mile.

Attached is an aerial photo and 10 small maps depicting the subject speed zone.

Stephen C. Kologi

SCK:GC:mb:3/n

Attachments



NASHUA
VALLEY COUNTY
MONTANA
EXISTING SPEED ZONE
PROPOSED SPEED ZONE
END FAP RTE 17:
508+40.2 END S 332(6) ≏
744+28.1 F 144(5)
706+51.1 F 144(5)
CITY LIMITS
455+19.2 S332(6)
CITY LIMITS(SCALED)
SPEED LIMIT 25
SPEED LIMIT 35
SPEED LIMIT 45
SPEED LIMIT 55
STOP
Cemetery
INDIAN
36
31
1
6
FAP 1
2
FAP 17
117
NASHUA ST
BLVD
HOBART ST
WARNHAM
ALLAN
BURLINGTON
FRONT
STEWART
TRUMPER ST
FORD
RIVER
VAN BUREN
DAVIS
SPENCER
TAYLOR
2ND
STATE
COTTAGE ST
POPLAR ST
WILEY ST
MAHON ST
GERRARDE ST
CHARLES
ROSEMARY ST
SARGENT
MABLE
2068
MILK
RIVER
Sewage
Disposal
Ponds
N

St. Regis Speed Zone - MT 135 Cont.

Murray moved the following speed zone revision on MT 135 be approved. Archambeault seconded; motion carried.

35 mph begins at the intersection of Mullan Trail Road and MT 135 on Project S 216(2) and proceeds north to Station 8+00 approximately 800 feet north of Mullan Trail Road. A distance of 800 feet and an increase of approximately 200 feet in the length of the 1981 approved speed zone.

45 mph begins at Station 8+00 and proceeds north to Station 16+00 approximately 1,600 feet north of Mullan Trail Road. A distance of 800 feet and an increase of approximately 200 feet in the length of the 1981 approved speed zone.

The total distance of this speed zone is .3 of a mile.

FAU 5205 - Great Falls

The City of Great Falls requested a speed study on FAU 5205 (River Road).

The area studied was 4.7 miles long; all two lane. The City officials agree with the Department's recommendations.

Murray moved the Commission approve the following speed zone revision on FAU 5205. Foster seconded; motion carried.

30 mph begins at Station 105+00 approximately 1800 feet south of Central Avenue and proceeds north to Station 80+00 approximately 550 feet north of Central Avenue. A distance of 2500 feet.

35 mph begins at Station 80+00 and proceeds along FAU 5205 to Station 65+00 approximately 2500 feet west of the Giant Springs Road. A distance of 14,500 feet.

45 mph begins at Station 65+00 and proceeds along FAU 5205 to the point where the subject route intersects 10th Avenue South.

The total distance of the speed zone revision is 3.7 miles.

MT 117 Nashua

While doing routine maintenance on signs the Glendive District requested correct speed zones for Nashua. There were no approved speed zones on MT 117 south of Nashua. An informational meeting with the town council was held to describe speed zone methodology. Recommendations resulting from the study have been reviewed by the town officials. They agree with only part of the results. The town officials like the idea of step-down zoning, but want to move the 25 mph and 35 mph portions further out away from town. To do as the town requests would make the 25 mph zone as much as 19 mph restrictive.

Archambeault moved the Commission approve the following speed zone revisions on MT 117 - Nashua. Murray seconded; motion carried.

25 mph begins at the intersection of U.S. 2 and MT 117 on Project S 332(6) and proceeds south and then west to Station 479+00, approximately 100 feet west of River Street, a distance of 2,900 feet.

35 mph begins at Station 479+00 and proceeds west to Station 472+00, approximately 100 feet west of Trumper Street, a distance of 700 feet.

45 mph begins at Station 472+00 and proceeds west and then south to Station 458+00, approximately 1,100 feet south of Stewart Street, a distance of 1,400 feet.

The total distance is .9 of a mile.

CERTIFICATES OF COMPLETION

Foster moved the Commission accept the following certificates of completion for the months of June and July, 1988. Murray seconded; motion carried.

MONTANA DEPARTMENT OF HIGHWAYS
Helena, Montana 59620

MEMORANDUM

TO: Steve Kologi, Chief, Preconstruction Bureau

FROM: Don M. Harriott, Administrator, Engineering Division

Don M. Harriott

RE: Commission Action
Speed Zone - MT 117 - Nashua

DATE: August 25, 1988

ATTENTION: Greg Jackson, Manager, Traffic Unit

The Montana Highway Commission approved the following speed zone changes on MT 117 - Nashua at their August 25, 1988 meeting.

25 mph begins at the intersection of U.S. 2 and MT 117 on Project S 332(6) and proceeds south and then west to Station 479+00, approximately 100 feet west of River Street, a distance of 2,900 feet.

35 mph begins at Station 479+00 and proceeds west to Station 472+00, approximately 100 feet west of Trumper Street, a distance of 700 feet.

45 mph begins at Station 472+00 and proceeds west and then South to Station 458+00, approximately 1,100 feet south of Stewart Street, a distance of 1,400 feet.

The total distance is .9 mile.

DMH:CMS:c

Date Recd. Preconst. 8/30/88

| Act | Info | MAIL ROUTE | Attach | Initial |
|---|---|---|---|---|
| | ✓ | WSK | | |
| | ✓ | Stg. Statistics | | |
| | | 31 [illegible] Plans | | |
| | | [illegible] Road Design | | |
| | | 33 Environment | | |
| | | 34 Hydraulic | | |
| | | 35 Bridge Design | | |
| | ✓ | 36 Traffic | | |
| | | 37 Pub. Hearing | | |
| | | 38 Photogrammetry | | |
| | | 39 Consultant Design | | |
| | ✓ | B. Russell | | |
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| | | File | | |

MONTANA DEPARTMENT OF HIGHWAYS
Helena, Montana 59620

MEMORANDUM

TO: Bruce Russell, P.E.
District Engineer - Glendive

FROM: Gregory A. Jackson, P.E.
Manager - Traffic Unit

RE: Speed Zone Changes - MT 117 - Nashua
Commission Approved

DATE: September 14, 1988

Attached is a copy of the latest Commission minutes regarding the MT 117 speed zone revisions. The minutes were approved on August 25, 1988.

Please have these changes implemented as soon as possible and in accordance with Management Memo 85-01.

Also attached are plan sheets with the approximate stationing for the placement of the new signs.

36:GAJ:GC:cm:3/o-1

Attachments

cc: D. D. Gruel

DEPARTMENT OF HIGHWAYS

TED SCHWINDEN GOVERNOR

2701 PROSPECT

STATE OF MONTANA

HELENA MONTANA 59620

September 14, 1988

Colonel R. W. Landon
Scott Hart Building
Sixth and Roberts
Helena, MT 59620

SPEED ZONE CHANGES
MT 117 - NASHUA

On August 25, 1988, the Highway Commission approved a recommendation for a speed zone change in Nashua on MT 117.

Attached is a copy of the approved recommendations.

Stephen C. Kologi

STEPHEN C. KOLOGI, P.E.
CHIEF - PRECONSTRUCTION BUREAU

36:SCK:GC:cm:3/o-2

Attachment

MONTANA DEPARTMENT OF HIGHWAYS
Glendive, Montana 59330-0890

MEMORANDUM

TO: Greg Jackson, P.E., Manager
Traffic Unit

FROM: Donald F. Williams DFW
District Traffic Engineer

RE: MT 117
Nashua Speed Zone

DATE: November 4, 1988

The subject speed zone signing changes have been put into effect since the end of last month. A new reduced speed ahead sign will be installed when available to replace the speed zone ahead.

DFW:jlw:5p

cc: District File
Wolf Point